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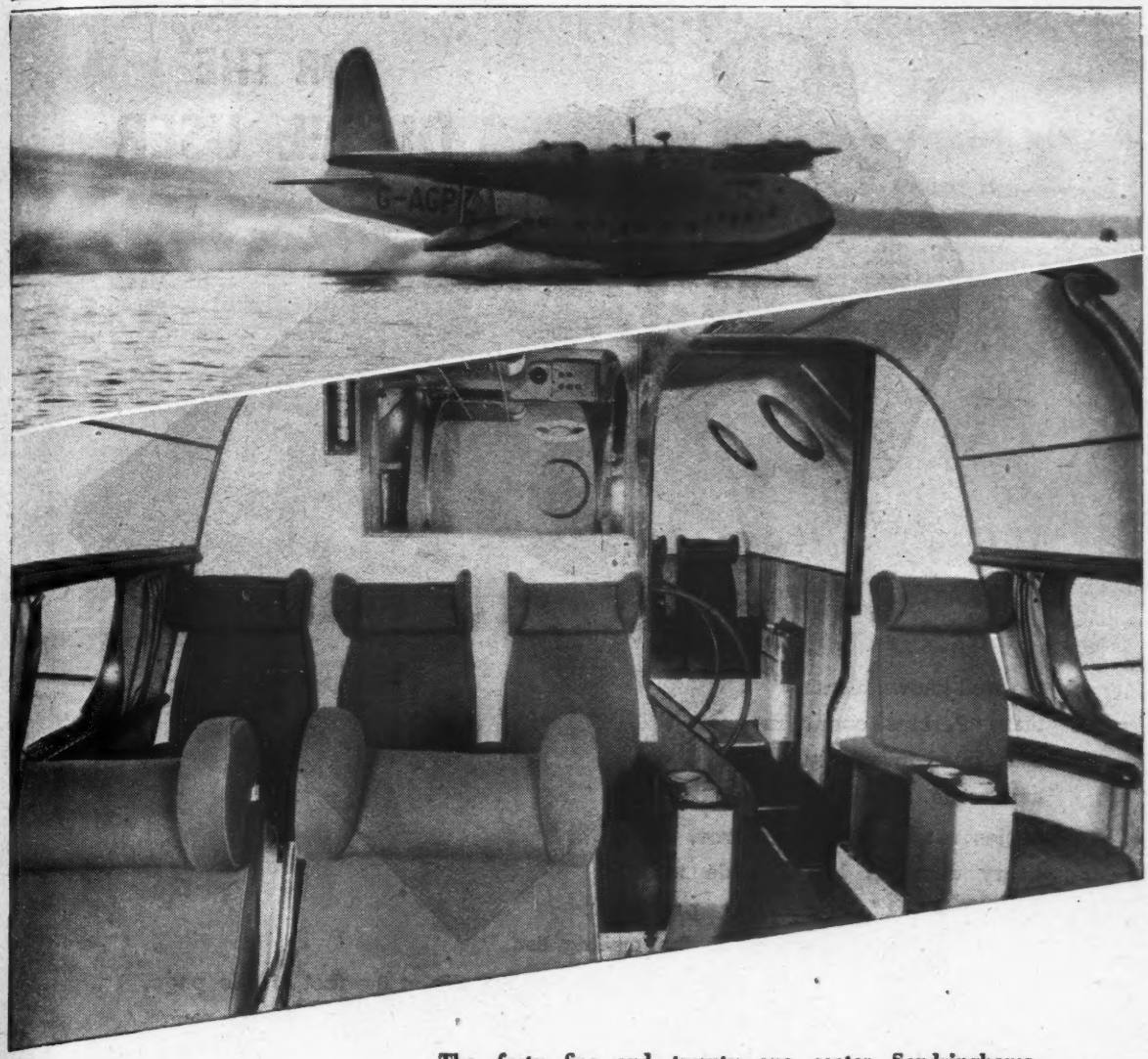

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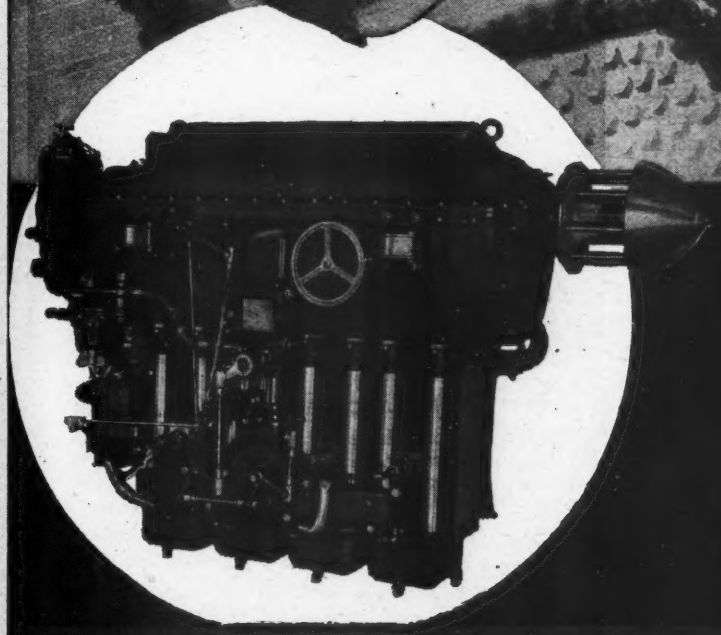

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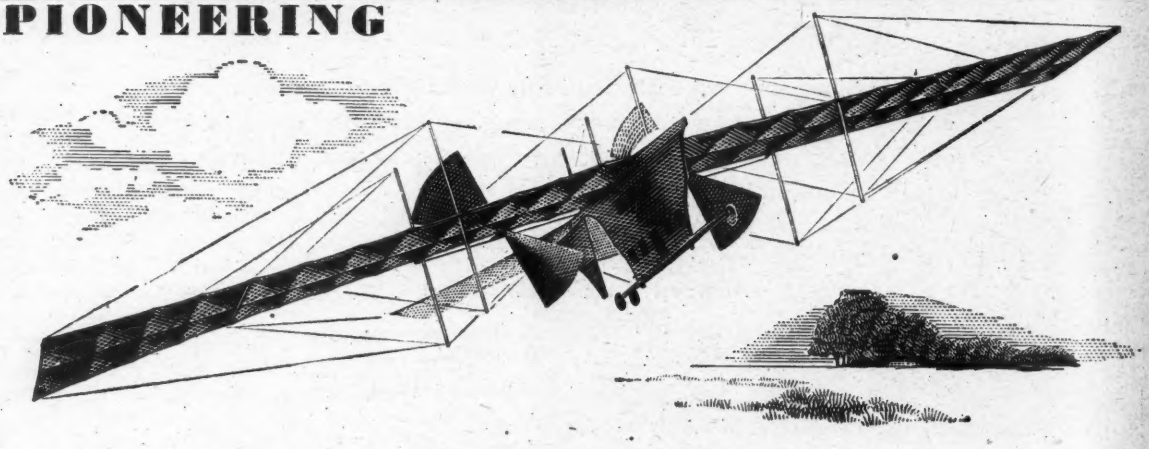

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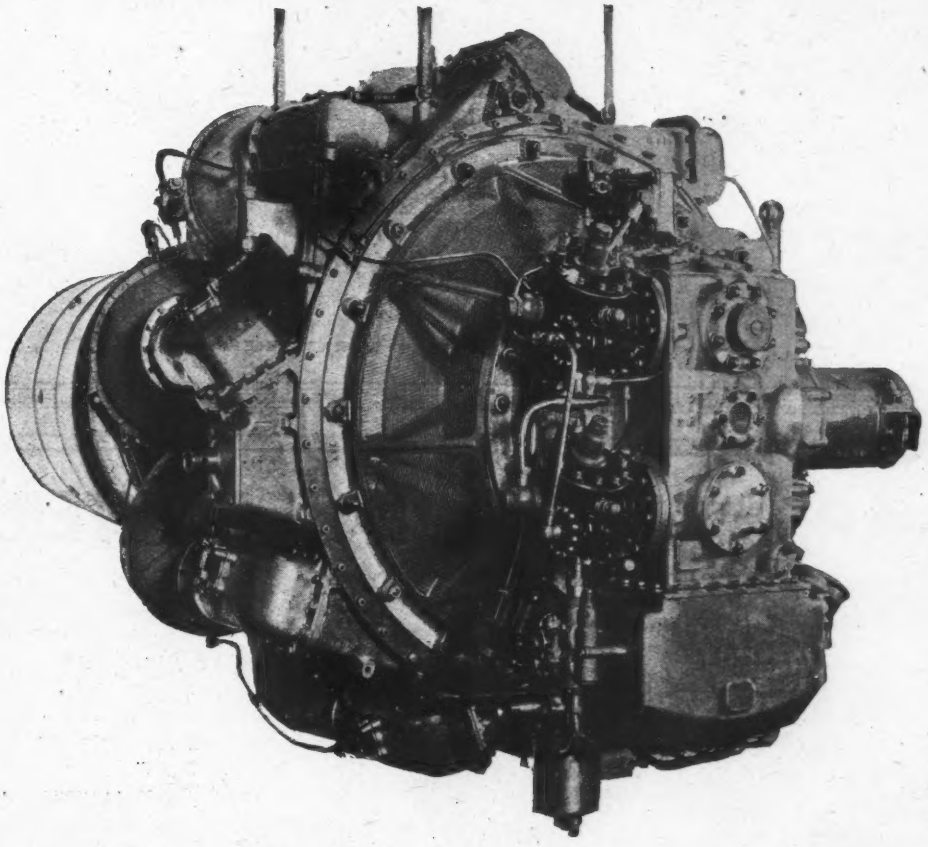

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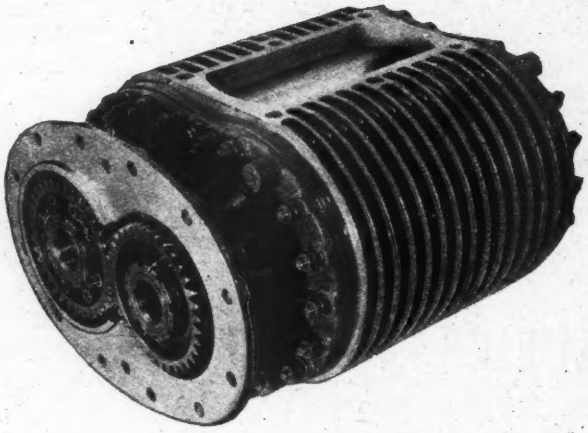

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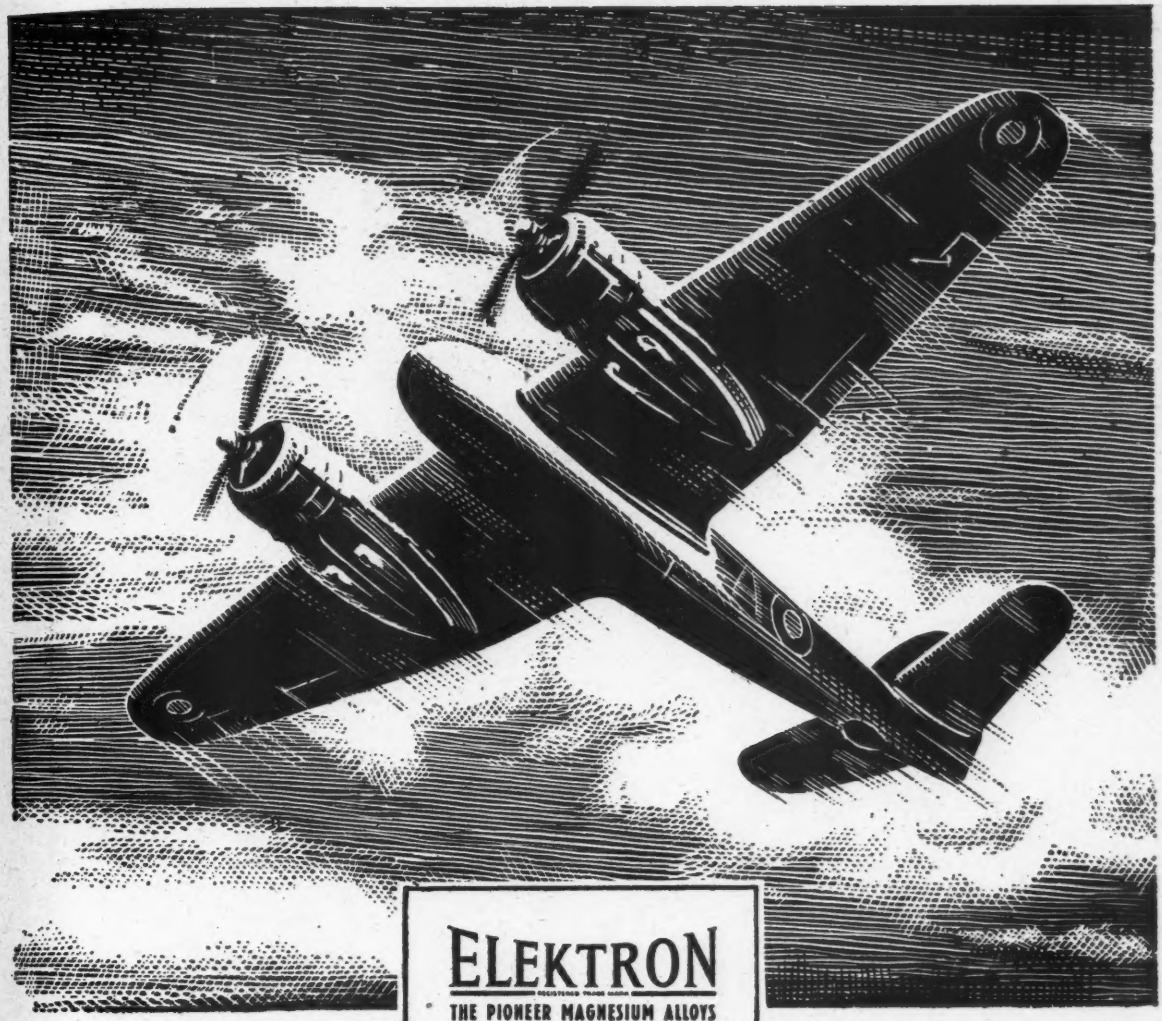

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The Outlook

Jet Propulsion in America

MANY weeks have now elapsed since it was first reported that an American attempt was to be made on wresting from Great Britain the world's speed record of 606 m.p.h. One should not be very surprised at this, and the delay is readily explained by two simple facts: the American newspaperman's tendency to confuse possibility with accomplished fact, and the difficulties inherent in the record attempt itself.

Do not let us forget that in this country we made the self-same mistake. The news that an attempt was to be made on the speed record leaked out long before the machines were ready, and although the final result justified all expectations, there was an impatient interim between it and the first announcement, during which the question was frequently asked, "are they *ever* going to do it?"

As for the American chances, our English correspondent in the United States, in his "American Newsletter" this week, does not appear unduly worried. Indeed, there is no reason why he should be. If our good friends on the other side do succeed in beating our record, no one in this country will fail to give them full credit for their achievement. From all accounts they will have a difficult proposition. The P-80 is reported to be a very fine aircraft up to its Mach number, but this is believed to be below that corresponding to 1,000 km/hour, which will probably be the speed aimed at by the Americans. As we have previously pointed out, this figure has a high prestige value due to the fact that the official world's speed record is recorded in metric units. American jet manufacturers will also have made noteworthy progress if they can produce units capable of delivering the necessary thrust. The possibility should certainly not be ruled out.

On our side, that fact would not in itself disturb us overmuch, for it must not be thought that we have been standing still since Herne Bay. Should the Lockheed P-80 or the Republic P-84 succeed in reaching 1,000 km/hour (which is the really attractive figure) we have no doubt that the Gloster and Rolls-Royce concerns will be quite ready to meet the challenge. But as "Kibitzer" quite rightly points out, even a temporary American success over the speed record will have the effect of rendering very difficult the possibility of selling British turbine-airscrew units for installation in some of the large American aircraft which need them if full use is to be made of their qualities.

From A to B

THAT the helicopter will be nearly twice as fast as any of its competitors over journeys of 120 miles was the somewhat surprising conclusion arrived at by Mr. Raoul Hafner in his lecture reported in this issue. Even up to distances of 400 miles the helicopter can, according to his estimate, hold its own in competition with the "airliner."

Among the factors which were employed by Mr. Hafner in his calculation were a helicopter cruising speed of 100 m.p.h. and a marginal time loss (the time spent between the terminus and the centre of the town) of 20 minutes. Both may be slightly optimistic, although the fact that a helicopter needs relatively little space should enable its termini to be located in the suburbs of a town, if not actually in the town itself.

Even when making allowance for a certain and understandable optimism on the part of Mr. Hafner, who has been a rotating-wing enthusiast and a successful designer of that type of aircraft for many years, there is obviously a bright future ahead of the helicopter—some day. But that day cannot be said to have actually arrived. There are still a number of technical problems awaiting solution (Mr. Hafner himself referred to "a thousand-and-one headaches"), and until a solution has been found, and thoroughly proved by testing, it would be well not to expect too much too soon.

Radar for Airlines

IN view of the intensive development and extensive use of radar during the war, one wonders to what uses this wealth of knowledge and experience can be put now that commercial aircraft of all types are claiming our chief attention. It is no secret that most of the radar equipment used on R.A.F. machines was costly to produce and maintain, and in many cases was both heavy and bulky.

The great dependence of Bomber Command, to quote an example, on its radar blind-navigation and bomb-aiming equipment is amply demonstrated in an article on Pathfinder duties and technique in this issue. Even though the bomb load and speed of the bombers was of paramount importance, the sacrifice of space and weight occasioned by the installation of up to five radar devices in addition to radio and other special navigational equipment was accepted without hesitation. Taking figures recently quoted by Sir Robert Watson-Watt, radio equipment including H2S (700 lb) totalled only 1,310 lb or approximately 2 per cent of the total weight of a Lancaster. Sir Robert added that it was certain that the weight of present equipment could be substantially reduced. The Tudors I and II carry approximately 1,000 lb of radio equipment, i.e., one-half per cent less of their all-up weight than the Lancaster. For the Brabazon I the 1,050 lb of radio equipment will represent only 0.42 per cent of the all-up weight of the aircraft.

Radio or radar for the detection of cumulo-nimbus clouds and tropical storm centres is a practical possibility which has recently come in for consideration and discussion and this would be a most important step towards accident prevention at worst or at least towards punctual and comfortable passenger flying.

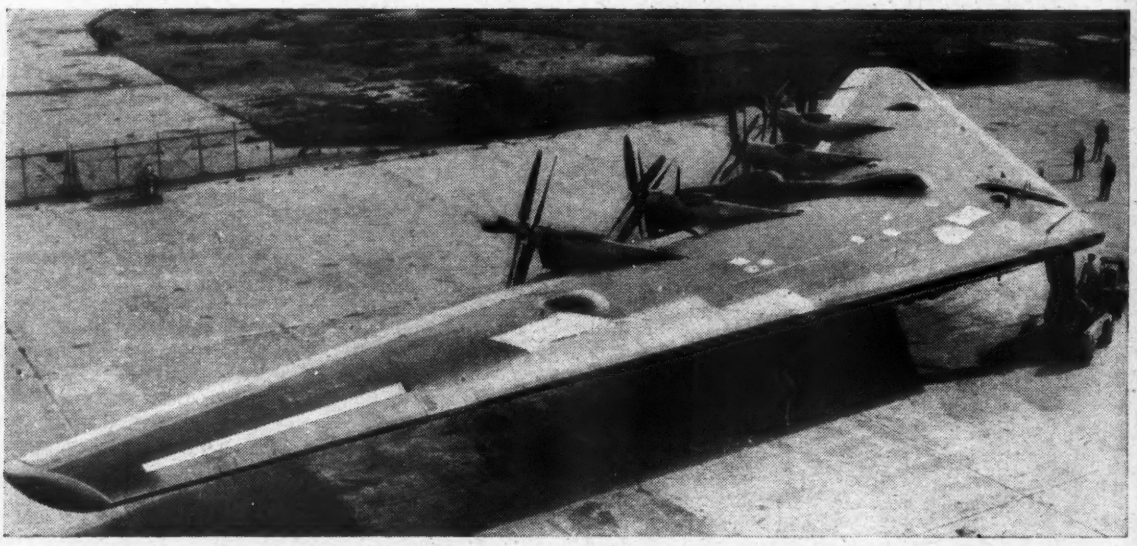
While the term radio can be used to embrace radar, the converse is not true. Undoubtedly pure radio will come into ever-increasing use particularly for short-range navigation, homing and traffic control, but radar with its freedom from distortion, unintentional jamming and interference due to atmospheric conditions also has an important place as a navigational aid and for blind approach to airfields.

The range limitation of Gee, the most practical and simple to use of the present radar navigational aids, is more acute for airline usage than on bombing sorties, and not the least of the difficulties—geographic and international—on Empire routes is the positioning of ground stations. It is gratifying to know that in spite of this a comprehensive network of Gee chains for Transport Command is nearing completion on our Eastern and Middle Eastern routes.

Assuming the ultimate need for a series of such radar networks for safe and regular international airline operation, it may be necessary to pool resources to meet the expense of ground installations and their subsequent operation and maintenance. An alternative is the use of a self-contained navigational aid of the H2S type. The advantages of such a set, independent of ground stations and range limitations, may well be considered to offset its weight and cost penalties. The stowage of the "black boxes" and, even more important, the detrimental effect on performance of external aerials, still remain as a radio and radar problem.

CONTENTS

The Outlook	433
Helicopters	435
Here and There	437
Goblins at Munich	439
Flying Club News	440
American Newsletter	441
The Mosquito	442
Pathfinder Story	a
Civil Aviation	448
Correspondence	450
Aeronautics and the Metallurgist	452
Service Aviation	454



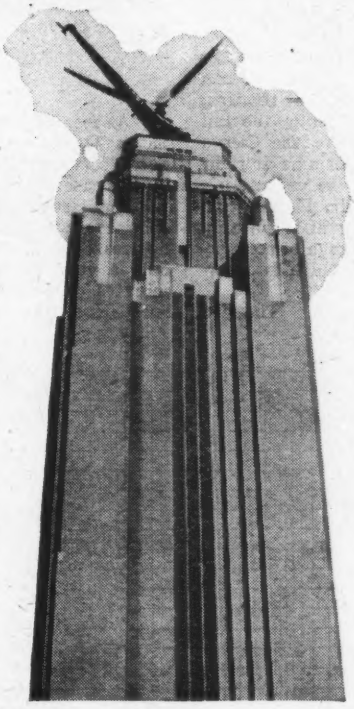
AMERICAN ALL-WING: Following a study of the handling characteristics of their small-scale N-1M experimental all-wing design, the Northrop Company have now released some details of the XB-35 bomber prototype. Four "buried" Pratt and Whitney 28-cylinder Wasp Major engines give an aggregate output of 14,000 h.p., driving pairs of contra-rotating airscrews through extension shafts. Wing span is 172 ft and the wing area 4,000 sq. ft. Notable features of this 120,000 lb not-very-clean flying wing, are the air intakes in the leading edges and the transparent starboard nose section of the leading edge.

Helicopters

By RAOUL HAFNER

Some Developments in Rotating-Wing Aircraft

A Lecture Given to the Society of Licensed Engineers



"I BELIEVE I am not making an over-statement when I say that the rotary wing to-day is a much bigger and more complicated subject than the fixed wing. There is hardly one aspect of the fixed wing which does not apply equally well, perhaps in a slightly modified form, to the rotating wing. But on the other hand, there exist now a thousand-and-one headaches of the rotating-wing variety which the designer of fixed-wing aircraft is very fortunate to miss altogether."

Perhaps this sentence from the lecture given by Mr. Raoul Hafner last Saturday to the Society of Licensed Aircraft Engineers helps to explain why progress appears to have been so slow in spite of the amount of attention concentrated on the subject during the last four or five years.

The story goes back much farther than that, of course, and Mr. Hafner himself, now in charge of helicopter development at the Bristol Aeroplane Co., Ltd., has had many years of experience. Before the war he designed and built the Hafner gyroplane, which was not a helicopter but had a "windmilling" rotor. The machine had many ingenious features and flew quite well. Helicopter projects followed it, and arrangements were in hand for actual manufacture. One very ingenious design had a fuselage of approximately aerofoil section, the idea being that the rotor slipstream should impinge on this, the resultant force acting in such a way as to counteract the rotor torque. Details of the Hafner-designed Bristol helicopter have not been disclosed, but it is certain that his work will play an important part in rotary-wing development.

A large section of Mr. Hafner's lecture was devoted to explaining the fundamentals of rotating wings, and the different types of aircraft of this general class. These, however, may be assumed to be fairly familiar to readers of *Flight* through various articles we have published, and we therefore propose to deal with certain other aspects of the lecture.

Control and stability have been the stumbling stones of helicopter progress from the very beginning. It was known and proved in the early days that a direct-lift machine was possible, but how to control it once it was airborne was the problem. Mr. Hafner pointed out that the normal fixed-wing aircraft has four "freedoms of movement" (speed, pitch, roll and yaw). The helicopter has a fifth "freedom," the linear acceleration along the vertical axis of the aircraft, or in other words vertical ascent and descent. This freedom makes an extra control necessary. Owing to the fact that helicopters operate over speed ranges beginning at zero speed, ordinary movable control surfaces are not satisfactory. A very powerful control exists, however, in tilting the rotor itself, and this is the method now generally used. Other methods have been suggested and some of them tried.

Two general systems of rotor articulation have been used: tilting of the rotor hub, as in the Autogiro, or a cyclic pitch change in the rotor blades, as used in the

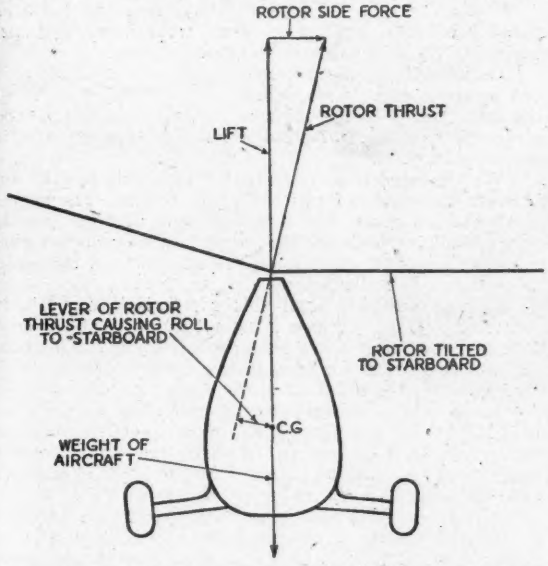
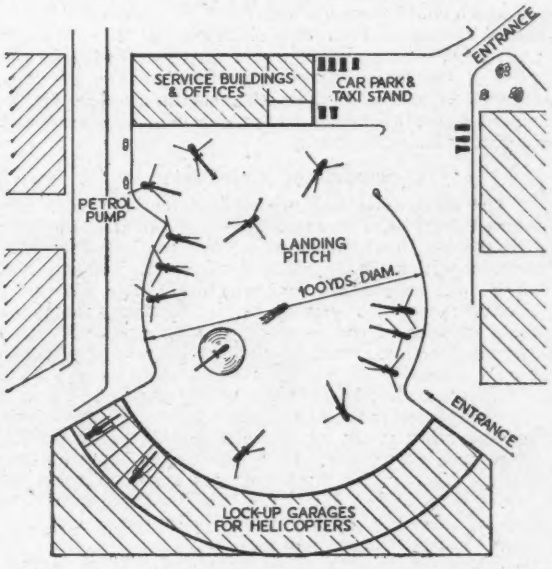


Diagram of helicopter seen from the stern, showing tilted rotor causing roll to starboard.



Not an insect colony but Mr. Hafner's suggestion for a helicopter station of modest but sufficient dimensions.

HELICOPTERS

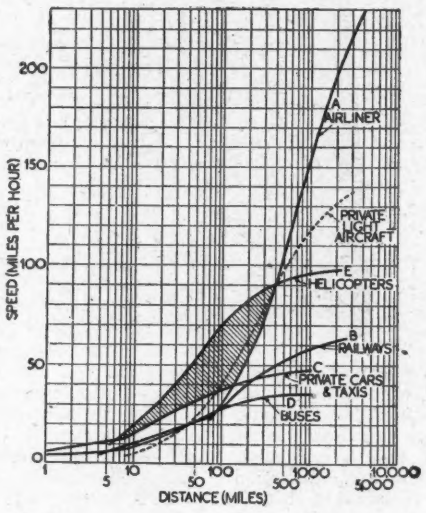
Hafner gyroplane. The latter method is now generally used in helicopters.

Mr. Hafner next outlined a number of possible helicopter layouts. With a single main rotor, torque reaction can be avoided by having the blades driven by jets at the tips, or it can be counteracted by a transverse jet in the tail (such an arrangement has been patented by the Cierva Autogiro Co.), or by a tail airscrew with its axis at right angles to the fuselage, as in the Sikorsky. In yet another form (which seemed to be favoured by Mr. Hafner) use is made of the induced airflow by placing in it suitably shaped vanes. This scheme has the advantage of recovering the rotational momentum and energy which is otherwise lost in the slipstream.

Twin-rotor helicoptors were then dealt with. The two rotors can be placed side by side and with their axes parallel, and rotate in opposite directions. Or they can be one behind the other. They can inter-mesh if they are geared together, or overlap fully when they are placed coaxially one above the other. Equal-size rotors inclined to one another are another possibility, but they leave a residual torque. Mr. Hafner concluded this section of his lecture by venturing the view that the small helicopter which carries the equivalent of a motor car load will be of the single-rotor type, while the large will have two rotors.

Making the somewhat optimistic assumption that the helicopter has "arrived," Mr. Hafner examined its uses as a link in transport, and gave a sketch (which we reproduce) of how a helicopter landing and parking place might be laid out. He visualized such helicopter stations distributed densely over the countryside as well as in towns.

Investigations made indicated the possibility of building helicopters which could operate at approximately 1½ times the cost of operating a taxi.



Speeds of transport, showing advantage of helicopter over journeys up to 400 miles.

After examining overall travel speeds, allowing for the speed of the main transport medium, number of stops, marginal time loss, and weather conditions, Mr. Hafner showed some interesting curves, the comments on which we give in his own words.

Surprising Conclusion

"The remarkable fact arising from curve A is a pronounced decrease of mean effective speed of transportation with the length of the journey. We see here that even under conditions of an efficient air service, which, it is hoped, will be attained at some future date, the mean effective speed of a journey of, for instance, 100 miles, would only be of the order of 30 miles per hour. It is obvious, therefore, that the air liner is quite unsuited for short journeys.

"Let us now see how rail transport compares. The railway companies have lately issued a statement, which, amongst other points of information, hinted at possible future speeds on railways. I have taken some of their figures. Usually, for short distances below 60 miles, the journey is made by a local train, and for distances of more than 60 miles, by express trains, with the use of local trains at the end of the journey.

"I have assumed a mean cruising speed for express trains of 65 miles an hour. To attain this the train would have to run at a speed of over 80 miles per hour for a good deal of the journey. Owing to the great density of railway stations, and the fact that they are suitably placed with regard to centres of activity, the average marginal time loss for rail travel is better than for air travel. It works out at approximately 40 minutes. These figures give the curve B for the mean effective speed of rail transport.

Road Transport

"As regards motor road transport, we face the following facts: The private car and the taxi represent a 'door-to-door' service. There is, therefore, no marginal time loss in this case.

"Bus services (and under this category I would put the special railway services which are provided in densely built-up areas, such as the underground and suburban lines) have only a very small marginal time loss, of the order of 20 minutes. On the other hand, however, the mean cruising speeds for these forms of transportation are low, due to the frequent stops or delays which are necessary in the interests of safety.

"As regards road transport, I have read with interest the proposals for roads and highways by the Post-war Reconstruction Committee of the British Road Federation, which indicate a scheme of motor highways for fast motor road travel, and a number of schemes for road traffic in built-up areas. On this basis I have assumed, as a mean cruising speed for cars, 45 m.p.h. on motor highways, which includes occasional stops, and a mean cruising speed, in built-up areas, of 16 m.p.h. The corresponding cruising speeds for buses are assumed to be slightly less. Thus we obtain two curves C and D.

"For air travel by helicopter I have assumed a taxi service. This means essentially that aircraft do not fly to timetables, but meet exactly the wishes of the traveller. This would apply, of course, equally to the private owner's helicopter. I have assumed twice as many helicopter stations as there are railway stations, excluding those of urban and suburban lines.

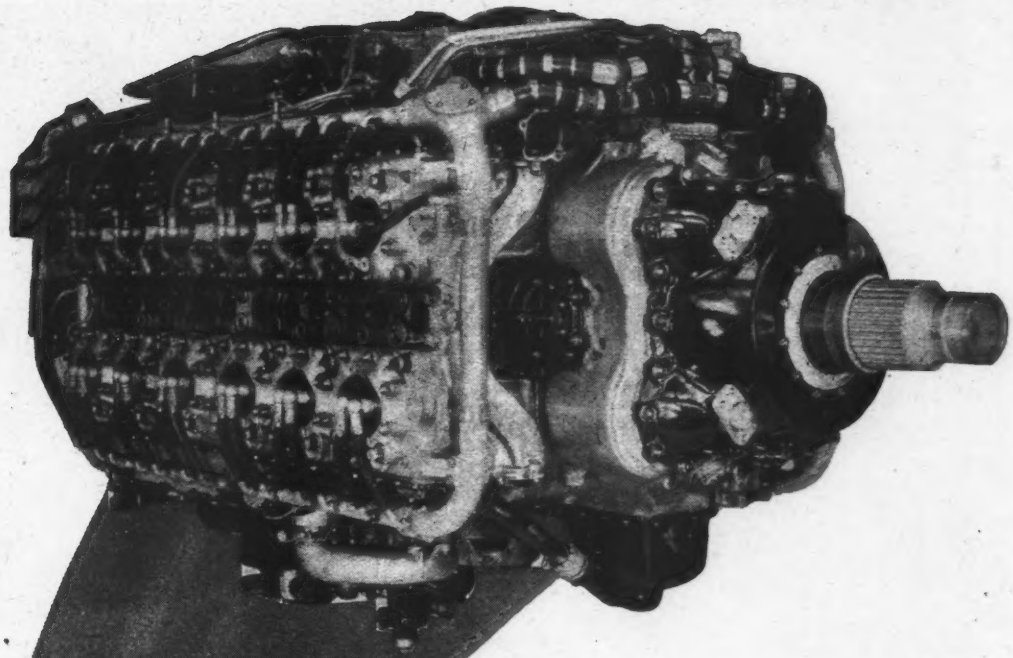
"On this basis, the average marginal time loss works out to approximately 20 minutes. The cruising speed of the helicopter is of the order of 100 miles per hour. The mean effective speed of helicopter travel, on this basis, is given by curve E.

"We are faced now with a very interesting comparison between the various forms of transportation. The curves intersect each other, and it can be seen that the private car, or the taxi, is clearly the fastest form of transportation for short journeys, whereas on the other side of the scale, the air liner is unchallenged.

"I have excluded from this comparison the private owner's aeroplane, because it cannot fly at night—at least I would not—and it is too much dependent on weather conditions. However, a representative curve for mean effective speed is shown dotted in the diagram.

"If we observe the curve for the helicopter, we find that it is faster than any other form of transport for journeys between 10 and 400 miles. In particular, if we consider journeys of the order of 120 miles, we find that it is nearly twice as fast as any of its competitors."

Mr. Hafner's somewhat surprising conclusions concerning relative speeds of various forms of transport were to some extent nullified by his admission that he had taken the liberty to "cook" the figures, but even making allowance for this, the helicopter obviously has a future.



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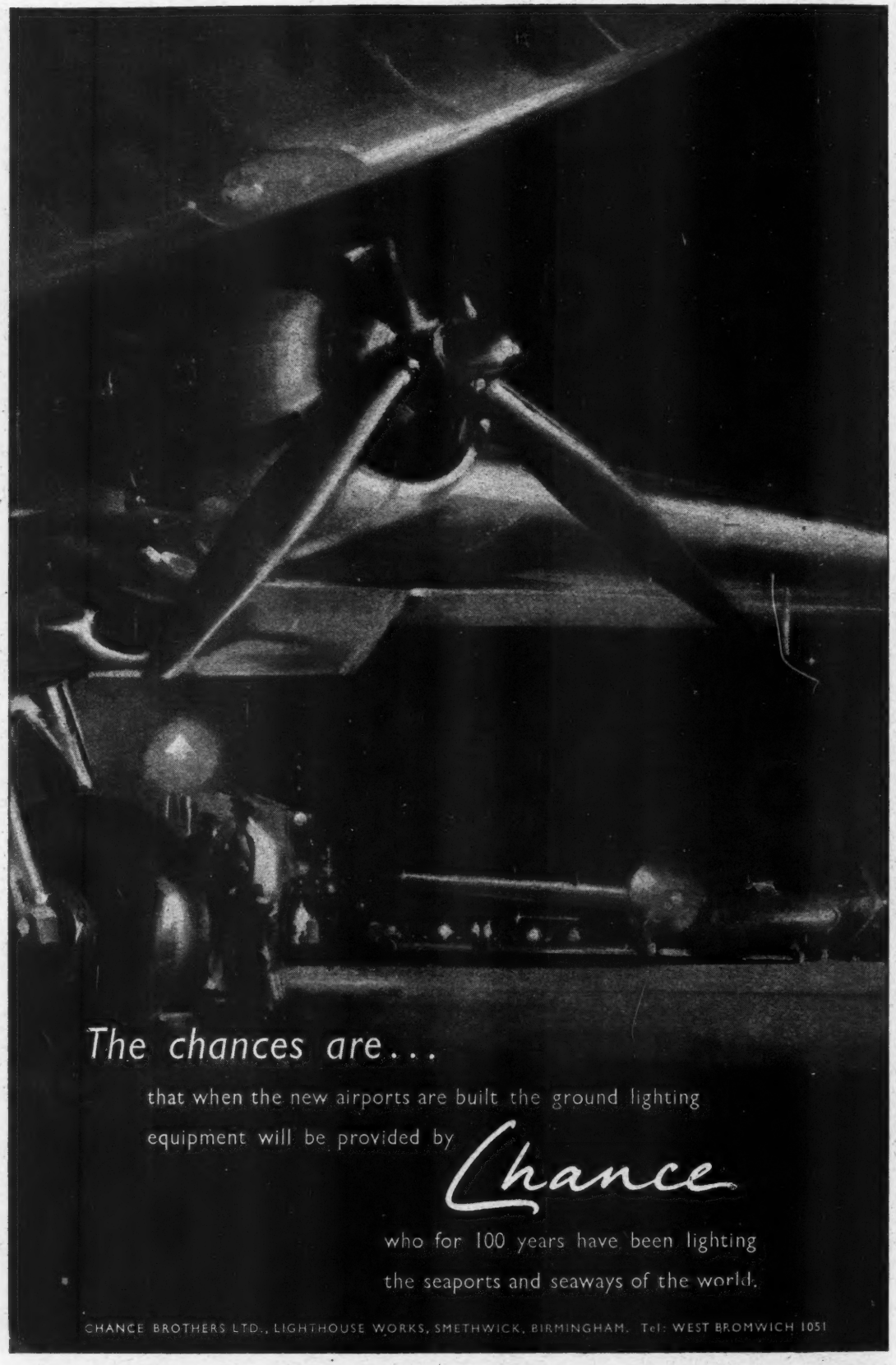
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HERE AND THERE

Tribute Paid

MORE than 55,000 visitors attended the "Tribute to Genius" exhibition in Piccadilly Circus in aid of the Spitfire Mitchell Memorial Fund which closed on Sunday last. It was opened by Group Capt. Max Aitken on April 3rd.

"Reactionaries" Foregather

WE referred recently to the disbanding of the original team of turbine jet pioneers who elected to retire from Power Jets Research and Development, Ltd., at the end of last month. This enterprising team has resolved to maintain contact in the years to come and have formed themselves into an association called "The Reactionaries."

The first dinner, in honour of Air Commodore Whittle, was held at the Hind Hotel, Lutterworth, on April 12th, the anniversary of the first run of Whittle's original jet engine in 1937.

The "Reactionaries" intend to meet at dinner in future years on the Saturday nearest to April 12th.

Safety Mission

AIR COMDRE. A. C. H. SHARP, head of the R.A.F.'s Prevention of Accidents branch, has recently completed a 28,000-mile tour of 65 R.A.F. stations between here and the Far East lecturing to personnel on how to keep down flying accidents.

The tour was made in a Mosquito with Flt. Lt. A. B. Lund as navigator and radio operator, and Air Comdre. Sharp said on his return to Northolt that he had no trouble in more than 100 hours' flying although his aircraft had received no attention beyond normal servicing.

The mission is regarded as one of the most important to be undertaken by a senior officer of the R.A.F.

Flying Kennels

FLYING horse-boxes we have already heard about; now it is flying kennels for whisking greyhounds to and fro across the Atlantic.

According to Maj. Gen. Michael Hogan, of Irish Airways, one American concern is already preparing for the expected Atlantic dog traffic by equipping airliners to carry as many as 50 Eire-bred greyhounds from Shannon Airport to the U.S., and Irish Airways plans to introduce a 15-hr service for the benefit of American track-operators who, it appears, are competing with British buyers for these valuable animals.

A similar "flying kennel" service between Eire and London, Glasgow and Manchester is also contemplated in the near future.

Dutch Demonstration

MR. JEFFREY QUILL, O.B.E., A.F.C., chief test pilot of Supermarines, put the Spitfire 22 through its paces for the Dutch civil and military authorities at Valkenburg airfield last week. This demonstration of fighting efficiency and aerobatics is said to be part of a plan by Vickers-Armstrongs to introduce the "Mark 22" to every country.

Mr. Quill did nearly all the development flying of the prototype Spitfire, including the first night flight. He saw service in a fighter squadron in the Battle of Britain, and was attached to the R.N.V.R. for carrier flying.

MODELLERS' MECCA: This young enthusiast is launching his model sailplane at the first airfield for model aircraft, opened at Easter at Eaton Bray, Beds. It covers 76 acres and is to have a canteen, workshops, and a seaplane "lake."

Accompanying Mr. Quill at the demonstration was Group Capt. L. P. Gibson, Mr. E. H. Mansbridge, of the design department of Vickers Supermarine works, and other officials of Vickers-Armstrongs and Rolls-Royce.

R.A.F. African Survey

A *REUTER* message from Accra, West Africa, last week said that R.A.F. aircraft are to carry out air surveys from altitudes of about 15,000ft over 145,000 sq miles in the British Colonies of West Africa as part of the ten-year programme of a central survey organization set up by the Colonial Office and financed by the Colonial Development and Welfare Fund.

Six Lancasters have already started the work, which is to be finished by the end of the year. They will then go on to East Africa.

Wartime News Sheet

JUST after the Normandy landings a daily news sheet called "Pegasus Goes To It" was introduced in order to keep the famous Sixth Airborne Division aware of what was going on.

To Major Charles Strafford on the Div. H.Q. staff fell the "combined operations" of editor, printer, reporter, and distributor; having compiled the sheet he mounted his motor cycle and delivered it to the airborne troops.

Peacetime Journal

THIS news sheet followed the airborne boys across Normandy to the Seine, to the Ardennes, and over the Rhine into Germany until the Sixth returned to England shortly after VE-Day.

Now it has been replaced by a regular journal, *Pegasus*, which is to appear quarterly so that past and present members of the Airborne Forces can all keep

EXPERTS ON FORM: Messrs. Richard Lonsdale-Hands and John Tandy, professional industrial designers, who work with the blessing of the Board of Trade's Council of Industrial Design, confer over an interim model of the Tudor II's seating for B.O.A.C.

HERE AND THERE

in touch with current matters of common interest to them.

The first number has just been published, edited by Major Strafford, and the "Wearers of the Red Beret" will find it a bright and entertaining, as well as informative, shillingsworth.

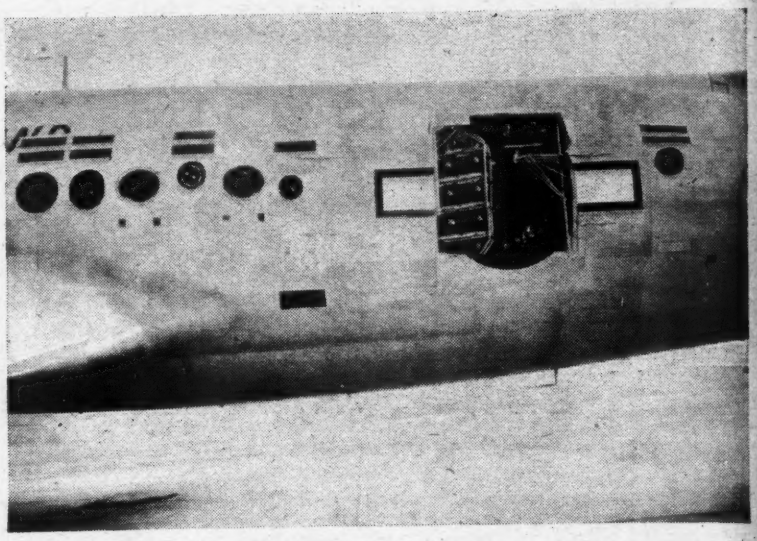
It is obtainable from the Manager, 70, Eaton Place, London, S.W.7.

Lucky Yanks!

SECOND-HAND ex-Army (and possibly ex-Navy, too) aircraft are obtainable in the U.S. at prices which will be the envy of every Briton who would like the chance to buy comparable types in this country as cheaply.

Two-seater, radial-engined trainers, for example, are reported as being sold off at the equivalent of £244-each, and Ab Jenkins, holder of the world's 24-hr record for cars, has bought a P-38 for about £312 just to get hold of the Allisons for another record car.

Nothing is said about the condition of the aircraft, which are most likely sold "as is"—to quote a current bit of Slanglo-American.



GETTING AN EYEFUL: When the Americans make their atom bomb test in the Marshalls, a specially converted C-54 fitted with 20 "still" and cinema cameras will record the visual effect. This picture shows the broadside battery along the port flank of the aircraft.

News in Brief

TWENTY-THREE of the 50 suggestions already put forward by workers in the new Dunlop factory at Speke (Liverpool) have been judged worthy of reward.

* * *

The Franklin Medal, the highest scientific award of the Franklin Institute, has been awarded to Sir Henry T. Tizard, president of Magdalen College, Oxford, for his contributions to aeronautical science.

* * *

Mr. F. H. Keast, one of the sixteen members of Power Jets, Ltd., who recently resigned, is to continue his research work with three of his former colleagues in the gas turbine division of the English Electric Co., Ltd., at Rugby.

* * *

The Northern Heights Model Flying Club is to hold its first post-war gala meeting at Langley airfield, near Slough, on Sunday, June 30th, 1946. The programme will include a contest for the *Flight* trophy for the best flying scale model.

* * *

A portable flight-engineer's station that eliminates half the air training time of flight engineers by instructing them on the ground has been developed by Lockheed. This device reproduces normal and emergency functions as applied to the Constellation, while lighting effects and "noises off" simulate realistic conditions.

* * *

The Australian Government, it is rumoured, is seriously considering the dropping of a permanent air force as a separate entity, and merging the R.A.A.F. with the Navy in view of the important part aircraft carriers are expected to play in any defence scheme for Australia and the Pacific.

* * *

Among the 500 Germans to be employed in the reconstruction of Wunstorf, one of the biggest R.A.F. airfields in Germany, will be 350 ex-*Luftwaffe* men. The work on the airfield is to start early this month. The existing 1,500yd runway will be increased to 2,000yd and another of 1,800yd built.

* * *

The R.C.A.F. Benevolent Fund increased by $1,084,768 during last year. During the year 2,913 applications for help were received, $33,319 was paid out in grants, and $113,006 in loans since partly refunded.

* * *

During a recent visit to America (his first), Marshal of the R.A.F. Sir Sholto Douglas was introduced to the U.S. President, Mr. Truman, by the British Ambassador, Lord Halifax. Sir Sholto replaces Field-Marshal Viscount Montgomery as Commander of the British Zone in Germany, and described his stay in the U.S. as "in the nature of a holiday."

* * *

M. Charles Tillon, the French Minister of Armaments and former Air Minister, said at the recent opening of the second French Aviation Congress that France was exporting aircraft to eight nations and hoped to test several French-built jet-propelled aircraft this year. The congress was attended by 3,000 delegates, including British, U.S., Russian, and Chinese representatives.

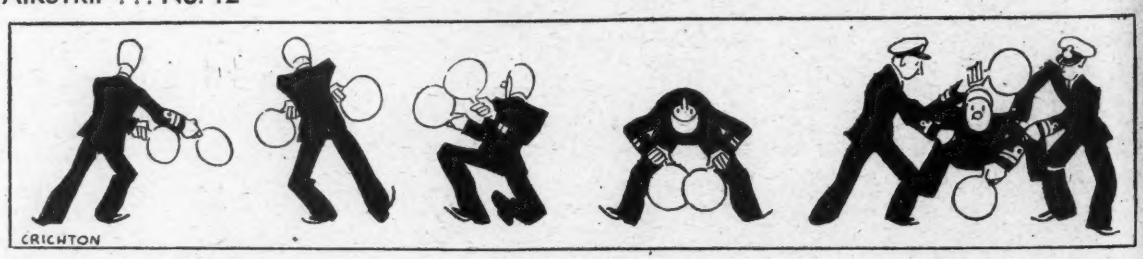
* * *

According to Mr. T. P. Wright, the U.S. Civil Aeronautics Administrator, nearly 200 air navigation facilities installed in 68 countries by the military forces of the U.S. are to be kept in operation for the benefit of the country's international air commerce.

* * *

Canada's Air Minister, the Hon. C. G. Gibson, recently disclosed in a report to the Canadian House of Commons that the $17,240,407 spent by the Dominion on training R.A.F. and Naval aircrews after the end of the Commonwealth Air Training Plan had been more than balanced by the $18,772,647 credit held by Britain, and that under the terms of the recent financial agreement between the two countries Canada will not have to pay the outstanding balance of $1,532,240.

AIRSTRIP . . . No. 12



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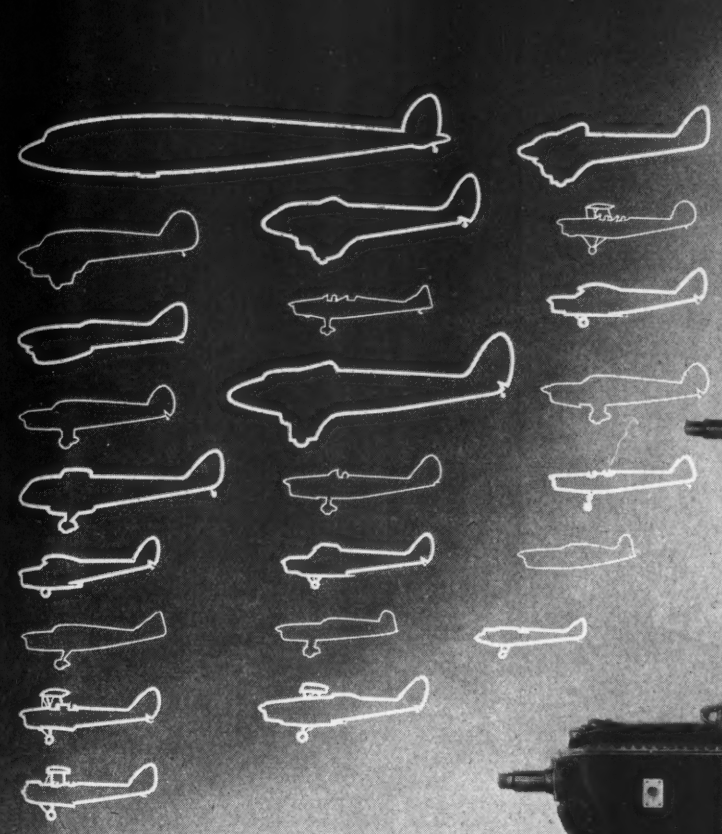

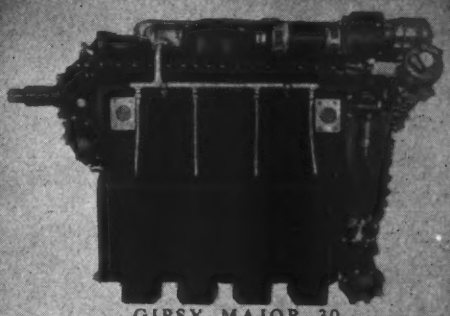

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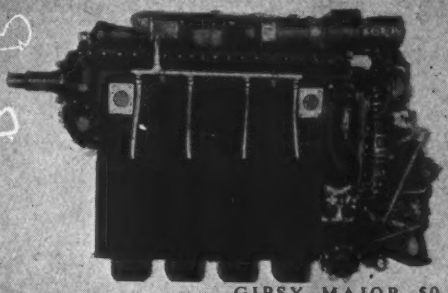

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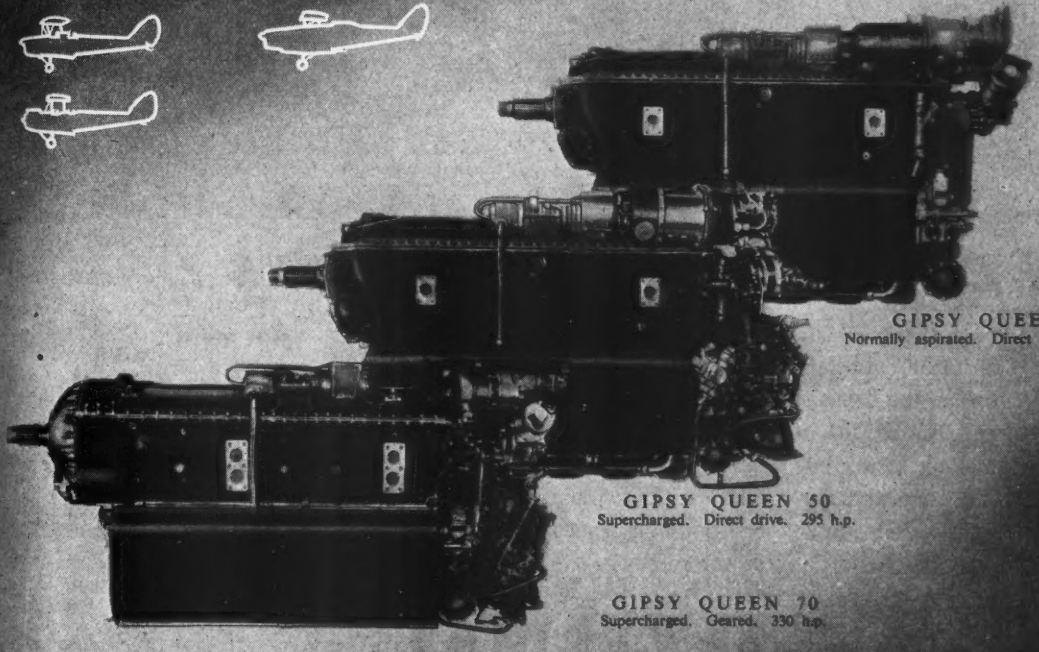

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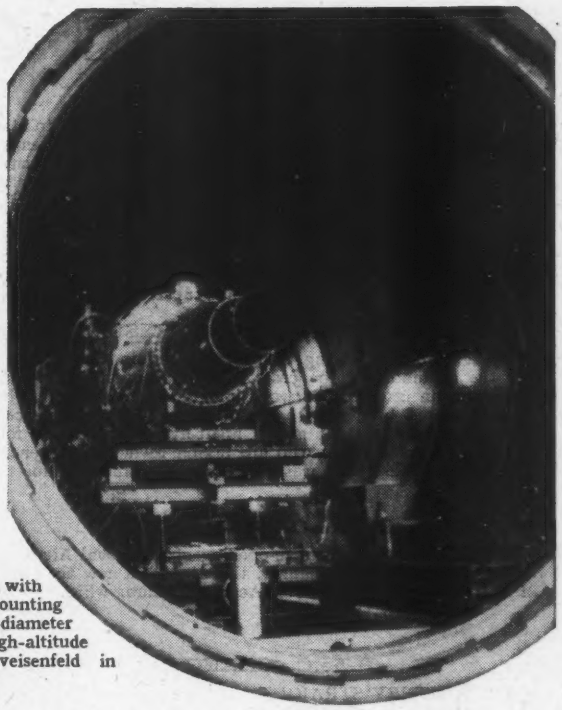
Goblins at Munich

D.H. Jet Units Tested in B.M.W. High-altitude Chamber

ALTHOUGH Munich and its environs were heavily bombed on several occasions during the war, and the Bayerische Motoren Werke at nearby Oberveisenfeld were heavily damaged, a special high-altitude engine test plant situated on the northern edge of the B.M.W. factory site was found to be serviceable when the area was overrun by the American Army. Building had been commenced in May, 1940; heavy bomb damage sustained in May, 1944, had been repaired by October. From then until the war ended, the plant was in regular service.

By agreement with the American authorities the Ministry of Aircraft Production arranged for the use of the engine test plant by certain British manufacturers, in particular the de Havilland and Rolls-Royce companies. In July of 1945 plans were made to test the Goblin I at Munich, and later, in view of the valuable data obtained with this unit, a Goblin II was also tested.



A de Havilland Goblin with specially adapted mounting installed in the 12 ft. diameter cell of the B.M.W. high-altitude test plant at Oberveisenfeld in Austria.

There is no other test equipment comparable with the B.M.W. plant in existence. The test cell is 12ft in diameter, is sealed and can be evacuated to pressures equivalent to an altitude of 50,000ft. Air can be supplied to the intakes at a speed of 550 m.p.h., and temperatures down to −65° C maintained.

It took twenty-one days to produce a special mounting and to make all the adjustments required to adapt the Goblin to the test plant, and a further fourteen days to install it. A series of calibrations were then completed uneventfully at various speeds at altitudes from ground level to 43,000ft.

It is interesting to note from a report on the tests that after completion of the first period of running the German engineers assisting with the operation of the plant asked whether they should open the cell so that the engine might be inspected. They were amazed that this was not considered necessary, as they had no previous experience of a jet engine that would run for more than five hours without attention. The particular Goblin was not examined until the whole series of tests, 42 hours' running in all, had been completed. The engine was re-calibrated on return to England, and the output was found to be substantially unaltered. Examination after stripping revealed the presence of a great deal of dust and some superficial damage resulting from the inhalation of dust-laden air from the heavily bombed area surrounding the test plant.

The second series of tests, comprising 71 hours of trouble-free running with a Goblin II unit, included observations of combustion and flame stability at altitude. Quartz windows were inserted in the flame tube, and in place of the normal periscope arrangement in the side walls of the test cell, windows were cut in the explosion doors on top of the cell. Engineers from the Lucas company, who co-operated in these tests, took gas samples from the exhaust. In order that engine thrust could be measured, it was found necessary to supply glycol to the sliding joints to prevent them freezing-up During tests the inside of the cell was brilliantly illuminated, and fog and ice formations under high-altitude conditions could be observed.

The D.H. Ghost

Basically similar to the Goblin, although it differs in outward appearance, the Ghost, second pure jet type to be produced by the de Havilland company, is already giving an output of 5,000 lb static thrust at sea level, an equivalent of 8,000 true sea-level thrust horse-power at 600 m.p.h. The Ghost embodies the same single-sided impeller design, single rigid rotating assembly and single-stage turbine as the Goblin series. It is claimed that if installed in a Vampire the Ghost would give a higher speed and rate of climb, and greater m.p.g. than any other unit, because it has a lower installed drag and weight per pound thrust than other engines.

RODWELL BANKS BACK WITH ETHYL

AFTER serving in the R.A.F.V.R. since the beginning of the war, Air Commodore F. R. Banks, C.B., O.B.E., was demobilized at the end of April and is returning shortly to his old firm, the Associated Ethyl Company, as technical manager.

Rod Banks tried to cheat his way into the R.F.C. in the first world war, but his youth was discovered, and he ultimately got into the Navy. Between the wars he concentrated on engine research and specialized in fuels for high-duty aircraft engines. He was responsible for the fuel used in the Supermarine Schneider winner, the Italian Macchi-Castoldi speed-record holder, and in many successful land and water records.

Early in the last war Banks joined the R.A.F.V.R. and was posted to the A. and A.E.E. at Boscombe Down as squadron leader. He had not previously had an opportunity to get his "wings," but qualified at the C.F.S. When France fell,

Self portrait by Air Comdre. Banks.

Banks was told by Lord Beaverbrook to "get more and better engine accessories," which he did. Eventually he was made Director-General of Engine Production, in which post he was responsible not only for engines but for airscrews and engine accessories. The task of placing production on a firm basis completed, Banks was transferred and, with the rank of Air Commodore, became Director of Aero Engine Research and Development. In this post he was, for more than two years, responsible for piston and turbine engines and also for the development of airscrews and engine accessories.

Rod Banks has done a good job in the Ministry of Aircraft Production, and as "Ethyl Banks" he will have much to do with fuels for the future. There may be special fuels for turbines, and anyway the piston engine will be with us for quite a time.

D

FLIGHT, May 2nd, 1946. Advert. 17

FLYING CLUB NEWS

BIRMINGHAM AGAIN

VERY soon now the Midland Aero Club is hoping to start flying again from Elmdon Airport, and the club premises themselves will actually be opened on May 4th. Three Austers have been allocated by the Air Ministry, and two new Austers have been ordered for delivery during the summer. The flying charges have been provisionally fixed at £3 an hour for dual and solo flying.

Mr. W. H. Sutcliffe, the former chief instructor, who is now chief test pilot at Dunlop's, is retaining his connection with the club, though not in his original capacity.

CAMBRIDGE PROGRESS

SINCE Marshalls Flying School reopened in Cambridge at the beginning of the year, it has put in something like 750 hours on instructional work, and the fleet of aircraft has been increased from one to seven. One of the most recent efforts has been that of giving night-flying training to four ex-A.T.A. women pilots who are taking their "B" licences. A goose-neck flare path was laid down at Cambridge for the purpose.

THE LONDON CLUB

FOLLOWING the official re-opening of the Royal Air Force Flying Club at Panshanger, this airfield is now the centre of operations for the London Aeroplane Club, which started flying with one Hornet Moth on April 23rd. Another Hornet, two Tigers and an Auster are at present being overhauled by the manufacturers, and it is hoped that they will be put into service before the end of next month.

As we have previously recorded, the provisional flying charge for all types will be £5 10s an hour, but if, as it is hoped, this charge can be reduced, the present flying members will be credited with any future reduction. Existing buildings at Panshanger have been adapted to provide offices, restaurant and a bar for the use of members.

WILTSHIRE REOPENING

THE re-formed Wiltshire Flying Club was due to start work again last Sunday, April 28th, from High Post airfield, near Salisbury. Austers are being used, three of which have been obtained and four of which are awaited from the manufacturers. In addition, there will also be a Magister for use. The flying charges have been fixed at £3 an hour, and the chief instructor of Flt. Lt. K. Burt.

During the war High Post was used by Supermarines for experimental and other flying. The grass runways, three in number, form a very great improvement on the landing area available in pre-war days. Incidentally, the fact that the club has started does not imply that High Post is yet opened to casual visitors by air. The Royal Artillery Flying Club will, as in pre-war days, be affiliated to the club, but will be providing their own aircraft.

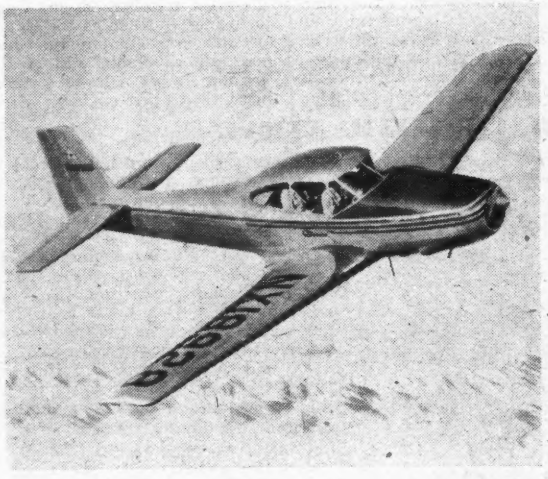
R.Ae.C. CHANGES

MR. WHITNEY STRAIGHT has been appointed chairman of the Royal Aero Club for the coming year, with Mr. Kenneth Davies as vice-chairman.

THESE MAY BE USED

QUITE apart from the various airfields which are restricted to scheduled or charter services, or are subject to the obtainment of prior permission, the following airfields can now be used by private owners and club pilots:—

Belfast (Sydenham), Bristol (Whitchurch), Cambridge (Teversham), Croydon, Derby (Burnaston), Guernsey, Hamble, Hanworth, Isle of Man (Ronaldsway), Jersey (St. Peter), Leicester (Desford), Luton, Lympne, Manchester (Ringway), Perth (Scone), Prestwick, Reading (Woodley), Southampton (Eastleigh), Sywell, Walsall and White Waltham. In addition, there is one seaplane base—Poole—and twenty-three otherwise restricted airfields.



NEW CIVILIAN: First civil effort of North American Aircraft, the Navion, is an all-metal four-seater cruising at 150 m.p.h. on 185 b.h.p. Details were given in the issue of April 11th. From what one hears the Navion is quite an exceptionally good little aircraft.

PACIFIC NON-STOP

THE first non-stop flight from Honolulu to the Philippines was made recently by a Boeing Superfortress which averaged 254 miles per hour for the 5,525 miles of the flight.

THE FIRST JET

LAST Friday the original Whittle-engined Gloster E.28/39 prototype was moved from Brockworth to its last resting place—the South Kensington Science Museum. Here, which is where the E.28/39 should, of course, remain for all time, it will serve to remind present and future generations of the leading place held by Britain in the development of turbine power units.

CLUB RECIPROCITY

IT may not be generally known to visitors from and to the U.S. that there is, in fact, a reciprocal agreement between our own Royal Aero Club and the Wings Club in New York. Members of either can avail themselves of the facilities of the other. Incidentally, the Wings Club has recently moved to the Biltmore Hotel, Madison Avenue and 43rd Street.

POST-WAR SOARING

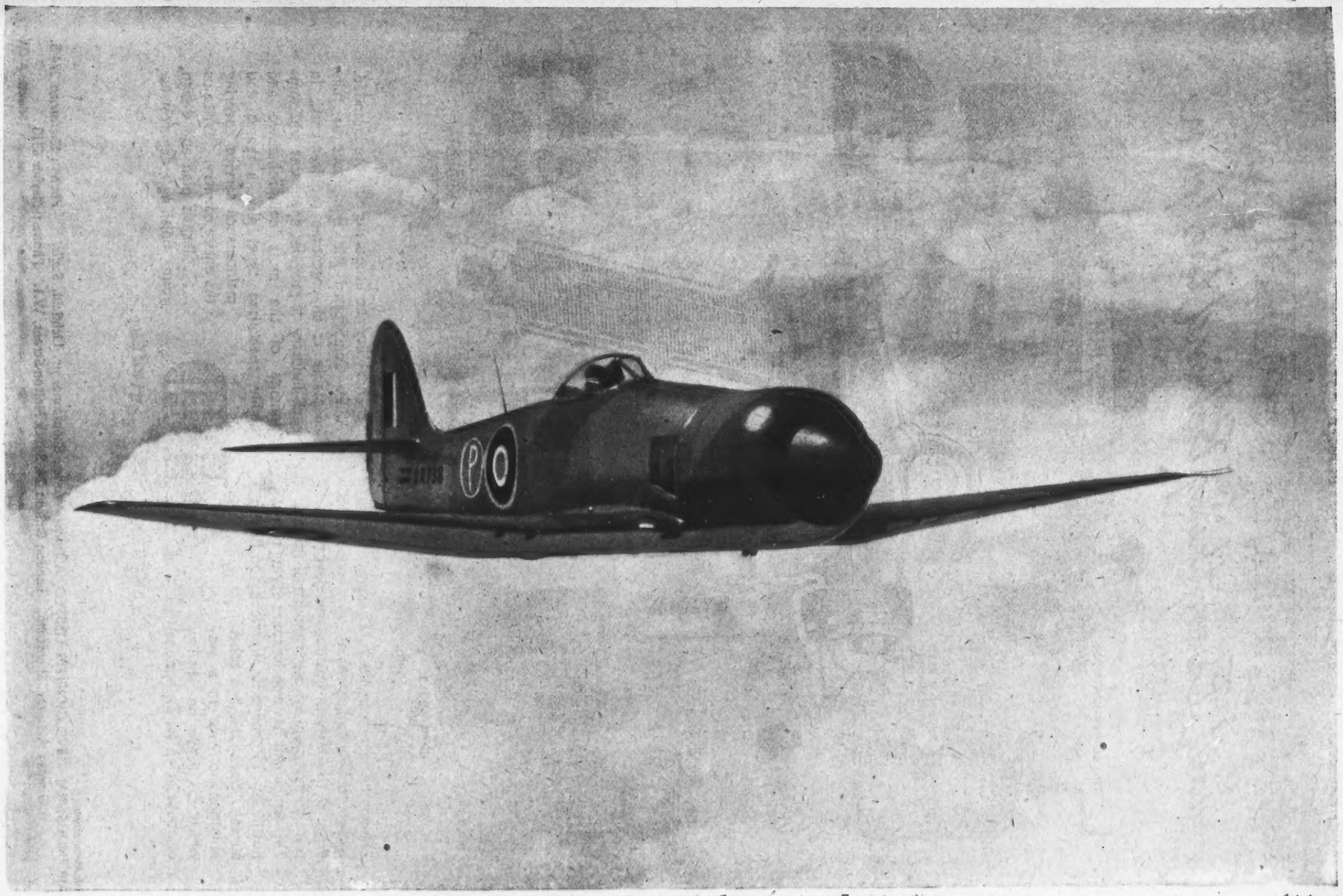
DURING the Easter week-end, at the first British gliding contest to be held since pre-war days, fourteen sailplanes were entered and flown from Rearsby airfield, Leicester. The more outstanding flights were of 63 miles, to Skegness, by D. G. O. Hiscox, and of 4½ hours duration by W. A. S. Pringle. The sailplanes, were, for the most part, launched by winch and during three days there was excellent soaring weather. A total of twelve cross-country flights were made.

The prize of the greatest aggregate duration by members of a club was won by a time of 9 hr 51 min by the Cambridge University Gliding Club, while the two prizes for height were won by Prince Bira, with a climb to 5,000ft from a winch launch, and by Mr. W. Morrison who climbed from 450ft to 8,150ft after being towed off.

KITTIWAKE REVIVAL

IN the days immediately prior to the war a cabin two-seater gull-wing monoplane was produced by Shapley Aircraft, of Torquay. This was called the Kittiwake and was powered by a Continental flat four.

The type has now reappeared and it is hoped that it will be eventually available in three forms. First, the SK-I, which is a single-seater in either open or cabin form; second, the SK-II which is generally similar to the original two-seater and powered by a Cirrus II engine; and third, the SK-III, which is to be a four-seater aircraft for more serious operations. The Kittiwake II cruises at 110 and has an all-up weight 2,600lb.

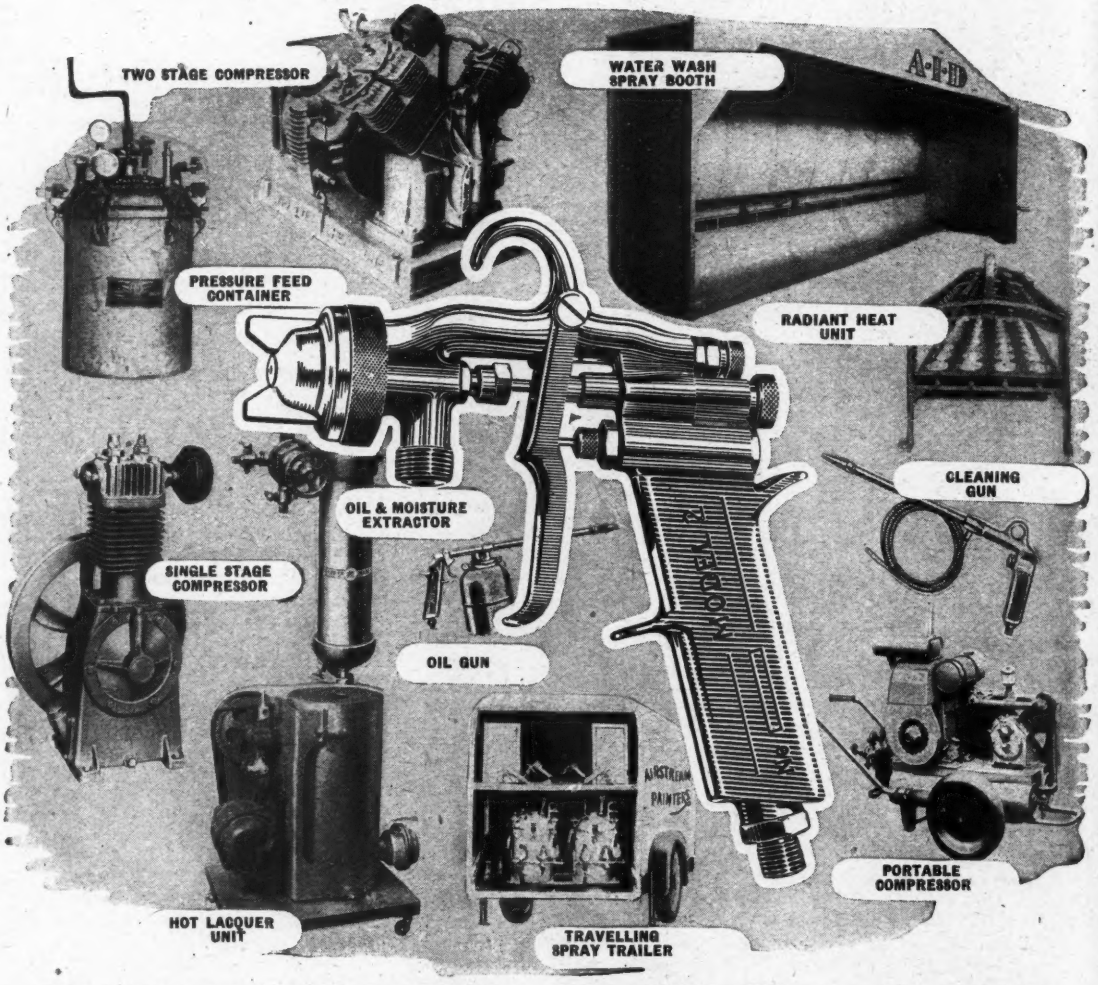


Hawker Sea Fury (*Bristol Centaurus Engine*).

Advt.

The GUN

and Everything Behind the Gun



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Scientific A 12A

American Newsletter

Making Full Use of "Mock-ups" : Some American Ideas : Service After Sales : The Record Attempt

By "KIBITZER"

ALTHOUGH there is nothing new about a provisional "mock-up," and some of the examples seen in British factories have been very complete and useful, the American aircraft industry may have a thing or two to teach the British about these pre-production "dummies." In the U.S. the high degree of skill and accuracy of construction which go into the building of these models would do credit to a Hollywood film set, and the results cannot fail to impress possible customers and to influence their thinking.

As competition becomes stronger and these "mock-ups," with their accompanying sales effort, become more important, fresh ideas and new ways of portraying the final machine will be introduced. One progressive aircraft manufacturer in the States, whose "mock-up" is a perfect example of well-thought-out presentation, has constructed the front portion of the fuselage, containing the pilot's cockpit, and has mounted it separately on a raised platform in a corner of the "mock-up room." This is hinged at its after-end, and, by operating an electrical switch of the overhead crane type, it is possible to raise or lower the front end of the fuselage to simulate the positions of climb, level flight or glide. Opposite the cockpit, and painted on the wall, is a runway, in excellent perspective, to give the illusion of flying over, or gliding towards the aerodrome.

An indicator beside the cockpit shows the observer not only the angle of the cabin but what that angle would represent in actual flight—such as maximum level speed, maximum permissible diving angle at cruising power, or an approach with power on and flaps and undercarriage down. A pilot is thus able to judge, and criticize if necessary, the view and the conditions that will be his during any particular manœuvre.

On another "mock-up" there was even an electric galley in working order, on which coffee was being made for exhausted customers. Once or twice during the summer air-conditioning has been fitted in the cabin, so that discussions could be held in extreme comfort while the customers were in the "mock-up" itself.

Cost and Effect

The good effect of this sort of thing even on the hardened domestic buyers is very considerable, and on foreign would-be purchasers it must be tremendous. It is a part of sales promotion that must not be ignored, and, although it is undoubtedly very expensive to do, its value cannot be estimated in terms of what a "mock-up" costs to build.

In the writer's opinion the very great success achieved by one of the larger American firms in obtaining a considerable number of advance orders for a machine not yet built is very largely attributable to an exceptionally well laid-out "mock-up." When this is aided by an obvious willingness to alter the internal design of both cockpit and cabin in order to meet the individual customer's wishes, orders will certainly result.

The manufacturers' service to the customer does not end with the "mock-up" or the delivery of the machine. Prior to delivery the firm will supply the prospective buyer with a vast amount of operational information. The average catalogue put out by the larger manufacturers over here is a magnificent production.

In order to help the buyer once he has actually bought his aircraft, various servicing schemes are being worked out. The Glenn L. Martin Company is considering the nominal renting of a replacement aircraft during periods of overhaul. Lockheed Aircraft are thinking of building service depots in England and throughout Europe to take care of their Constellations. Douglas may do the same, and one manufacturer is said to be fitting up an aircraft as a flying workshop.

From a later and more direct servicing point of view, a publication worth looking at is the Douglas DC-4 Servicing Equipment Catalogue. This is a book of some ninety pages with photographs or drawings of equipment on every page, showing very clearly the tool to be used and how it should be used. Many of these items were specifically designed to meet manufacturing problems and are now being applied to service and overhaul requirements.

Speed Record Attempt

An attempt on the world's speed record by two Lockheed P-80s is expected any day now. One machine is to be flown by an Army and one by a Lockheed pilot. Great value is set on this record, both by the aircraft trade and the Army Air Force, and the rather secondary position in which American jet and turbo-jet engines now find themselves has given an added urgency to this attempt. Personally, one is doubtful if this aircraft will capture the record, or, if it does, by much of a margin, and one of the British jet fighters now flying should be able to recapture it within a comparatively short space of time—a fact which the Americans fully realize.

But the important thing is that Great Britain has now a lead in jet and turbo-airscrew engine development, and may soon be in a position to sell the latter type to the American manufacturers. There are at least three good commercial aircraft in the States which require some such propulsion unit, and which will be underpowered if fitted with existing reciprocating engines. These are the Martin "303," the Douglas DC-8, and one (or perhaps two) of the really large aircraft which are due to fly in 1947. So far as one knows, there is no satisfactory American turbo-airscrew design available to fill this need. These manufacturers are undoubtedly interested in the British engines now under development, and if it were possible to bring them to the point of buying, we could collect some of those much-needed dollars, and raise British prestige as well.

Counter Measures

Should the P-80 or the Republic P-84 establish a record, however, there will be such a tremendous acclaim from the American Press as to the superiority of both American aircraft and engines that we may find it difficult to obtain sales in the face of public and political opposition. Two things seem to be necessary, therefore: first, to offer our wares as soon as we possibly can, and, secondly, to make our own arrangements to go after the speed record again ourselves should the Americans succeed in capturing it.

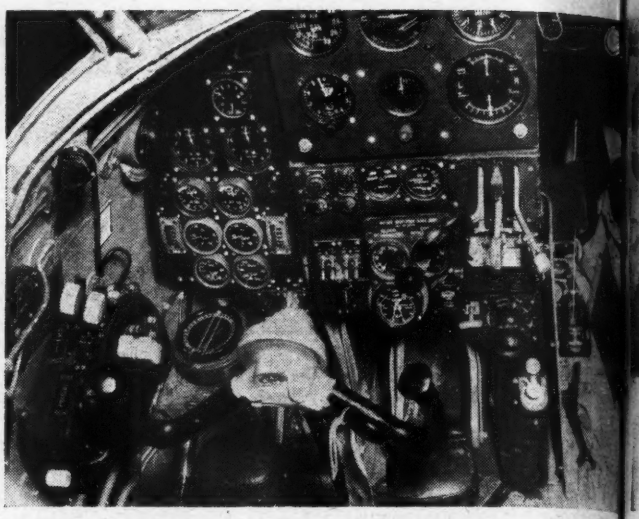
[Although "Kibitzer" is to some extent merely reiterating opinions and statements which have appeared in *Flight* during recent weeks, these comments are interesting since they are, so to speak, from more intimate sources and reflect current opinion where this opinion matters most.—ED.]

IN THE AIR XIV.

The Mosquito

Some Impressions of One of the War's Outstanding Aircraft : Advanced Simplicity

By "INDICATOR"



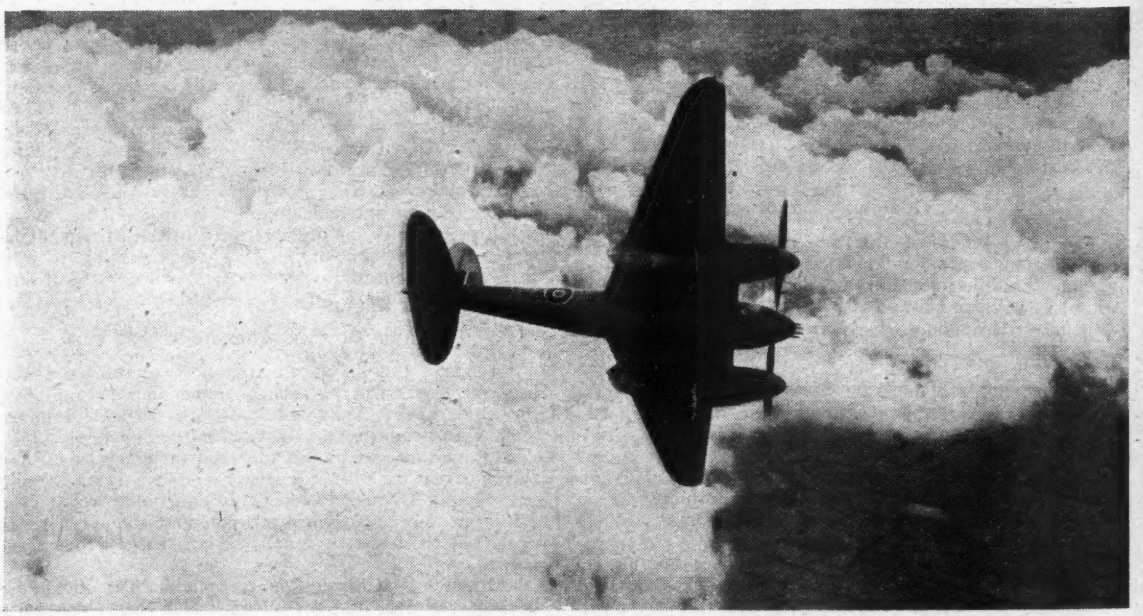
ONE should obviously have very clear-cut first impressions of any type as outstanding as the Mosquito. The majority of pilots came round to it more or less straight from twin trainers or even from the driving seats of single-seat fighters or four-engined types, and their feelings during the first hour or two on the type must have been strictly marked and lastingly remembered.

In my own case, after a little flying in such aircraft as the Whirlwind, and after a very great deal more flying in Beaufighters, the sensation of being provided with multi-engined power and prospective safety as well as fighter handling qualities was not quite so surprising. Certainly, apart from any unexpected lightness and vigour in the aileron control, my only outstanding memories of a first circuit in the Mosquito were of its comparative simplicity as a flying machine and of its strange resemblance to much less pugnacious de Havilland types. Though the wing loading of the Mosquito is probably nearly three times that of aircraft such as the lightly burdened Dominie, it still, somehow, appeared to have retained the same general qualities—all of them merely at a much higher position on the speed scale.

During those early days of Mosquito experience, nearly everyone had developed a bee in his (or her) respective bonnet about its capacity for weaving off the straight during take-offs and landings. There was nothing strange or unusual about this sort of reputation; nearly every new high-powered twin and quite a few new single-engined fighters had been libelled in the same way. Of course, the Mosquito *could* swing quickly and finally to its destruction during both take-off and landing if it was so permitted—but the same could be said of nearly every other aircraft in a similar relative performance category.

Ground Handling

With the centre of gravity so comparatively far aft in relation to the undercarriage, and with its fair supply of keel surface, the Mosquito required reasonably intelligent



Probably the most "handleable" twin of its time, the Mosquito's qualities were really appreciated when it first appeared in fighter form—as the Mark II, with stick control and flat screen. Later, this type was developed into the Mark VI fighter-bomber, which, though similar in appearance, carried a very considerable bomb load. As will be seen here, the plan-form of the Mosquito was nothing if not distinctive.

handling during the take-off, and could certainly not be allowed its head when landing across wind. But those who had not been over-warned, and consequently talked into a frightened state of mind before going out to fly the thing, rarely found any difficulty. I certainly found none—at least until I actually saw one squeal round in a semi-circle, leaving a cloud of dust and rubber-smoke.

Naturally enough, with the torque reaction of two Merlins to be considered, it was advisable to open up with sobriety and while leading with the port throttle, but rudder control appeared in good time, and unless an initial deviation had been allowed to develop without proper correction or the abandonment of the take-off, there was no reasonable excuse for expensive trouble.

Drift Arrivals

Any aircraft will tend to rush away in some direction other than the correct one while landing across wind, but, since control could be maintained with the Mosquito to the very point of touch-down, there was no real reason for completing any landing with a lot of built-in drift. Immediately after touching down across wind there was, of course, a tendency for the Mosquito to kick sharply into wind; if this tendency was not held firmly with opposite brake a swing *might* start and, once started in full measure, it certainly could not be stopped. And there was, of course, a wind-strength beyond which the drift could not be counteracted and in which the weathercock tendency was greater in force than the tractive resistance of the appropriate tyre on the landing surface.

In earlier days the Mosquito's undercarriage was a shade on the weak side laterally, and the most extraordinary distortions have once or twice been seen after a particularly violent exhibition of ground-looping. I remember one occasion when a pilot, who was comparatively new to the type and very new to the airfield, had obeyed the Tee rather than his own judgment after a very sudden and unexpected change of wind-direction, and increase in its strength. Things certainly happened. After he had landed on the appointed runway, which was, by this time, 90 degrees off a 35 m.p.h. wind, the Mosquito hung for a moment while travelling in a straight line with a jet of deep blue smoke from the heavily braked port tyre—and then hurried around in a twinkling pirouette. He taxied all the way back to dispersal, feeling possibly that there was something more than a little odd about the aircraft, but only after descending through the entry hatch and looking at the ground crew's faces, did he realize that both his undercarriage legs had distorted sideways at an angle of something like twenty degrees to the vertical.

G—Stalling

During their first twenty or so hours on the type quite a few Mosquito pilots went through a short period of minor difficulty with the final approach and landing. Nobody appeared to be troubled in any way during the first few hours, but people occasionally developed a tendency to make rather untidy arrivals during later hours—and particularly when more serious attempts were being made to "do short ones." The fact was that, while behaving with perfect normality if checked quietly and slowly from a reasonably high final approach speed, the Mosquito's landing could be G-stalled very easily on its powerful elevators if this check was made too rapidly and after the engines had been cut back. Probably the best system was to arrive at a point near the boundary with excess speed, to cut the throttles and to start the hold-off in good time. If a really short arrival was required, it was better, perhaps, to approach with plenty of motor at an initially low speed and to leave this power in action until the aircraft was in the three-point position.

My own form of temporary trouble was probably caused by a certain anxiety about overshooting while working from a field with comparatively short runways which were almost invariably out of wind. In trying too hard I was producing, on each arrival, a premature stall.

But after a few score of hours with the Mosquito some very surprising things could be done. With the judicious use of power, one could make the most absurdly short landings, and Mosquitoes have been put, experimentally, on to very small grass strips which had been originally laid out for the use of much less advanced types. The only real trouble with such satellite experimentation—especially when the approach and departure lanes were badly obstructed—lay in the Mosquito's none-too-bright performance when everything was down. The simpler undercarriage leg on the Hornet must have made a very great deal of difference both to the take-off and to the overshoot acceleration characteristics of the type.

One of the more pleasant feelings when test-flying the Mosquito lay in the knowledge that one had fuel enough to fly pretty well across the Atlantic. There was never any sensation of restriction, or excessive fear of being "stuck" over cloud, and the confidence, of course, was increased by the knowledge that there were two engines and that the outfit would fly very comfortably on one of them.

CONFIDENCE TRICK: This photograph of the feathered starboard airscrew of a Mosquito was actually taken at 1,000ft. Unless the speed was allowed to drop too much, the Mosquito's single-engined characteristics were just about as perfect as possible.

At one stage in the war we used to carry out long-period tests of radar equipment. In these a pair of Mosquitoes climbed up to 8,000ft or so, and hunted for one another above broken cloud for an hour or so before returning through the "undercast." With the range available it did not matter if one was a hundred miles away from the home airfield. We always tried to organize things so that the necessary cannon tests could coincide with these trips, and it was a relief, after using a combination of visual and fluorescent screen evidence during the radar hunt, to return to pleasurable "contact" flying at very low level. As in the case of the Beaufighter, in which the guns were also grouped in the nose, it was often possible, during these cannon tests, to see the shells proceeding on their way towards the pseudo-target. And there was no end of an opaquity of acrid cordite fumes after each burst of fire.

Certainly, the control reactions of the Mosquito were such that it would have been a crime to have left it in stolid bomber form, pure and simple, and no one was surprised when the first fighter type appeared with a stick control in place of the original half-spectacles. And the cabin was, in my opinion, much more suited to the use of a flat bullet-proof screen than to the vee screen used on

THE MOSQUITO

the bomber and P.R.U. types. With the necessary deicing sandwich arrangement, and, later, with the need for arranging the cabin to stand up to pressurization, the general view, though good for the class, was poor in comparison with that obtained with the screen and windows of the fighter and fighter-bomber marks.

In the course of routine testing, even at a Maintenance Unit, we learnt quite a lot about Mosquito control effects in general. As far as I remember, lateral trim defects at comparatively low speeds were dealt with in the ordinary way by the adjustment of one of the servo tabs, while defects appearing in the dive at very high speeds were cured by shimming the ailerons up or down at their fulcrum points. It was, in fact, possible to adjust the tabs so that the ailerons would be slightly over-balanced at low speeds when the flaps were down, and it was then necessary to readjust the relative settings of the two tabs. As an amateur technician, I should have said that the Mosquito was somewhat over-tabbed as far as the ailerons were concerned and a little bit "borderline" in control-balancing generally. Certainly the type was distinctly touchy where control adjustments were concerned. It was sad, too, that production requirements involved the use of unsuitable and over-stressed hydraulic items. One just accepted the fact that undercarriage re-selection was nearly always necessary after take-off. The story behind the hydraulic installation policy of using available gear is too long to be told here.

Naturally enough, with a machine which had been originally designed as an unprotected high-speed bomber, conditions for the crew were not exactly roomy, but the seats were slightly staggered to provide elbow space, and the two members soon learnt to divide duties in such a way that they did not impede one another. Apart from the fuel cocks—movement of which involved one in considerable contortions—everything essential was reasonably placed, and it was only a pity that it was necessary to change hands during the undercarriage-raising process. One felt, from the very first hour, part and parcel of the Mosquito—and that is a necessary but not very usual sensation to be felt in any really good aircraft.

Airworthiness Requirements

The P.I.C.A.O. Code and Some A.R.B. Recommendations

THE first Session of the Airworthiness Division of the P.I.C.A.O. recently ended its meetings in Montreal after four weeks of successful discussion. Forty-seven experts representing twelve member States, took part. The United States of America and the United Kingdom were strongly represented. The United Kingdom delegation, largely drawn from the Staff of the A.R.B., was led by Lord Brabazon of Tara, chairman of the Board. Mr. W. Tye served as his deputy and other members of the team included Mr. R. E. Hardingham, Mr. F. H. Boxall, Mr. E. J. Burn, Mr. W. M. Evans and Mr. D. M. Jameson.

The main task of the Division at the present Session was that of setting up an effective and comprehensive International Airworthiness Code to govern passenger aircraft operating commercially on scheduled international air services. The requirements agreed by the Division include structural loading conditions, general design and construction requirements, test schedules for engines and airscrews, fire precautions and emergency exit provisions. Airworthiness administrative procedures were drawn up to facilitate international transport, and special attention was paid to the performance requirements when one engine is inoperative.

Progressive dates of enforcement were agreed and these will give each nation ample opportunity to take all necessary steps to achieve the prescribed level of safety, without causing hindrance to existing production plans.

Final drafts of the proposals are at the moment being prepared in Montreal by drafting experts. As soon as these final copies are available, the A.R.B. will supply the limited number of copies available to all persons directly concerned. In due course the British civil airworthiness requirements will incorporate the international requirements so as to avoid any possible redundancy or ambiguity.

Throughout the meetings in Montreal the desire to achieve agreement was predominant. The various delegations frankly expressed their national viewpoints, but, where these conflicted, compromise solutions were sought and found. It was clear that national representatives were moved by the realization that in this as in all other instruments of peace it was the responsibility of every nation to collaborate in producing a satisfactory solution. Perhaps on technical matters the basic aim of all nations is so alike that the path to agreement has been eased, but the success of the Conference, and the friendly relationships which resulted, cannot be over-emphasized.

By way of a sequel to the 1944 Chicago Conference—in so far as this was concerned with airworthiness requirements—the Air Registration Board's volume dealing with civil aircraft design recommendations is more than interesting. This book, which was first published last year and has since been reprinted with editorial amendments, is virtually in three sections. The first of these consists of general and administrative recommendations; the second of detailed comments on the various sections of the Draft Annex G, which represent the United Kingdom's views on the subject and have been accepted by the Minister of Civil Aviation; and the third of a series of proposals for international requirements and recommended practices.

The A.R.B. has dealt most exhaustively with the whole subject. By way of example and in the course of the structural recommendations, the possible effects of slipstream on flap loading are, for instance, dealt with. It is suggested that investigations should be made to ensure that the unsymmetrical loading of the flaps, especially in conditions when the critical engine is inoperative and the remainder are giving maximum take-off power, is provided for, and that means should be provided to prevent any resultant difference in the flap settings and difficulty in control.

TWO R.A.F. GROUPS REPLACED BY ONE

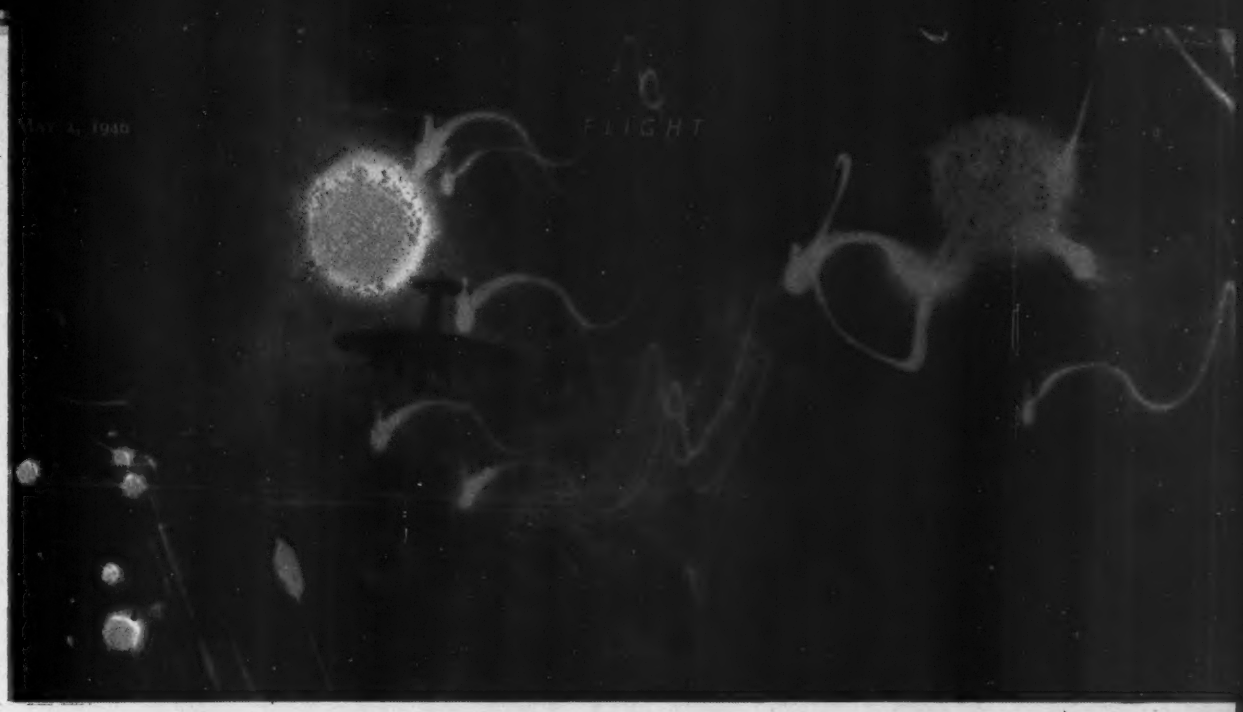
TWO wartime R.A.F. Groups—No. 26, which was responsible for Signals Communications, and No. 60, which specialized in radar—were officially dissolved on Thursday last, April 25th, and a new Group, No. 90, is being formed to combine the functions of both the old ones.

The two Groups now dissolved played tremendously important, though often unspectacular, parts during the war. Indeed, No. 60 Group's activities were among the "top secrets" while the fighting was on, for even when the story of radar was first partly told, no mention was made of this R.A.F. Group which Air Marshal Sir James Robb, A.O.C.-in-C. Fighter Command, described as "the eyes of Fighter Command," and whose work, in the words of Marshal of the R.A.F. Sir Arthur Harris, "completely revolutionized bombing."

No. 26 Group was formed in March, 1940, under Technical Training Command, but two years later it was transferred to Bomber Command and its responsibilities extended to cover all R.A.F. Telecommunications within and emanating from Britain. This included the installation of all ground, air and marine signals equipment, D/F and beam approach stations, R.A.F. Traffic Control Service, and the control of the Dispatch Rider Letter Service. It set up transmitting and receiving W/T stations in Britain, Iceland, and the Azores, and equipped thousands of aircraft, Air/Sea Rescue launches, pinnaces, landing craft, and other vessels. They also trained personnel.

The task of installing, maintaining and operating R.A.F. ground radar units in the U.K., and of training radar personnel for overseas service, fell to No. 60 Group which was formed in April, 1940, and placed under the operational control of Fighter Command, and the persistence of *Luftwaffe* attacks on ground radar stations during the Battle of Britain was the enemy's first tribute to the importance of the Group's work.

Besides building a complete chain of stations from the Orkneys to the Scillies to cover our entire coastline, this Group provided the radar navigation aids to Bomber and Coastal Commands and to the U.S.A.A.F. in this country.



PATHFINDER STORY

Problems of Night Bombing: Application of Radar Aids: Conception and Development of Target-Marking Technique: Concentration of Attack

By Wing Commander MAURICE A. SMITH, D.F.C.

THREE simple analogies will serve to illustrate the progress of night bombing during the World War: (i) If a shot gun is fired at a covey of birds the chance of hitting one is small and the damage slight; (ii) If a shot gun is aimed at a single bird, within normal range, it maims or perhaps mortally wounds; (iii) If a rifle is correctly aimed at the heart of a bird or beast, anywhere within range, the power of the gun, concentrated in the single bullet, kills. R.A.F. night bombing passed through three such stages. The earliest efforts often amounted to little more than a sprinkling of bombs over a comparatively wide area of enemy territory. Later, crews were able to find the approximate locality of a target, and to place a small weight of bombs upon it; while later still, it became possible to identify the very heart of the target, and to wipe it out by dropping a great and concentrated weight of explosives and incendiaries accurately upon it.

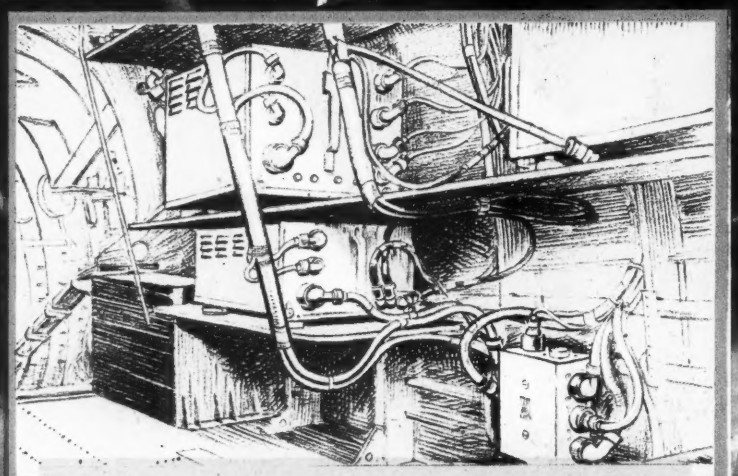
IN this description of the work of Pathfinder Force, the methods of marking a target and of controlling forces of night bombers are impersonally discussed. The P.F.F. contribution towards the success of Bomber Command, and the enormous increase in striking power made possible by accurate target marking at night is explained.

A discussion of the work of the first night-bomber crews is not strictly within the scope of this story, but it should be recorded that although the results were negligible by comparison with the huge raids which followed later, no job has ever called for more courage, endurance or skill. A handful of airmen, from a country cornered and fighting almost without weapons to break an attempted stranglehold, penetrated the organised defences of a powerful, fully-armed and confident enemy.

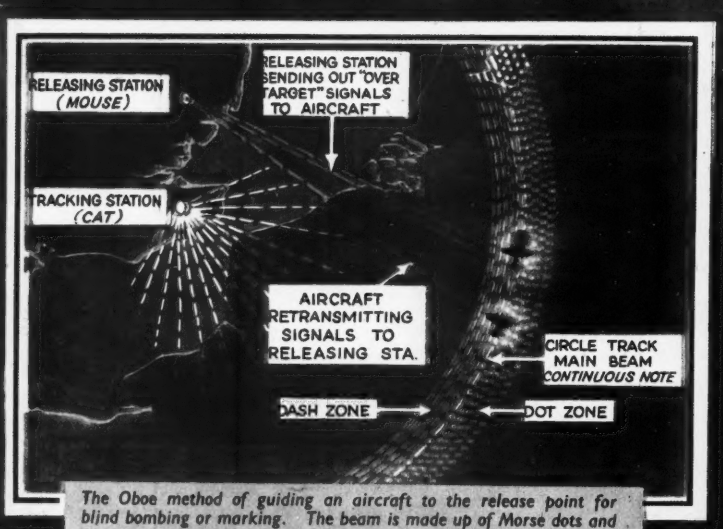
By comparison with recent knowledge and achievement, navigational practices in 1940-1 were elementary, aids were almost non-existent, aircraft were underpowered, of low performance and less reliability, adverse weather presented a far greater problem, and in fact, all forces seemed combined to confound these

After a tyre check and having run up and cleared the four Merlins, the Captain of a Lancaster gets his "O.K. for take off" flashed by a green aldis light from the control caravan at the end of the runway.

FLIGHT



Inside the Lancaster fuselage, approximately amidships, are some of the main components of the H2S radar bomb aiming apparatus.

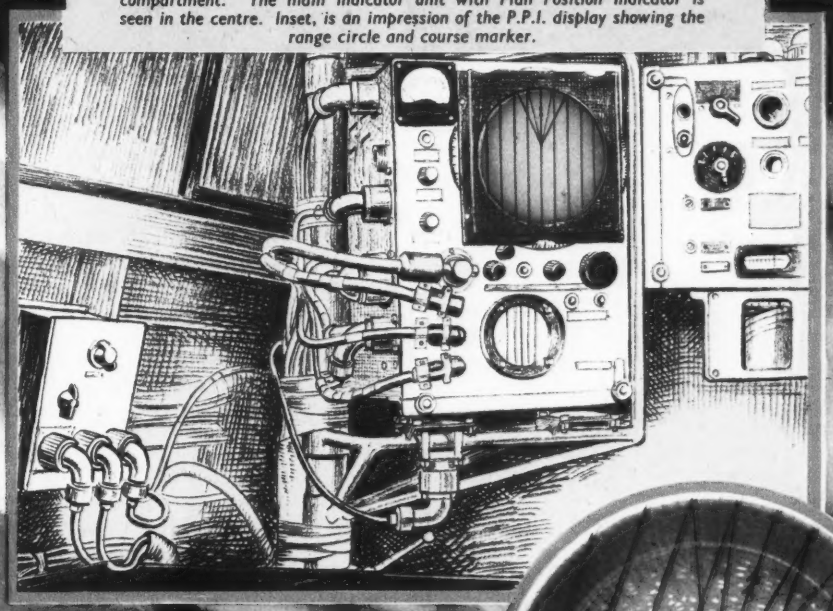

RELEASING STATION (MOUSE)
RELEASING STATION SENDING OUT "OVER TARGET" SIGNALS TO AIRCRAFT
TRACKING STATION (CAT)
AIRCRAFT RETRANSMITTING SIGNALS TO RELEASING STA.
CIRCLE TRACK MAIN BEAM CONTINUOUS NOTE
DASH ZONE
DOT ZONE

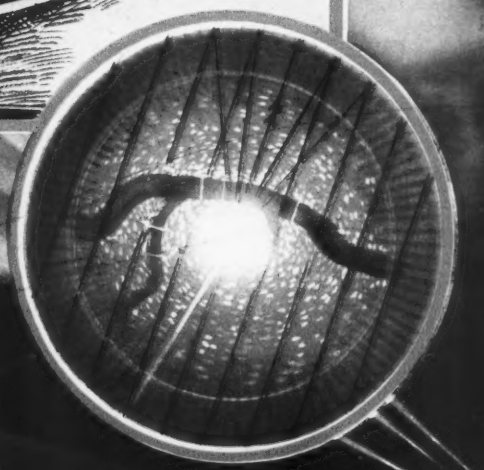
The Oboe method of guiding an aircraft to the release point for blind bombing or marking. The beam is made up of Morse dots and dashes in the same way as for S.B.A.

NIGHT PINPOINTING. *Lancasters and Mosquitoes of Pathfinder Force fly into the target area to open a Bomber Command night attack. Already two green target indicators are burning near the docks at the fork of the river, and enemy defences are active. No visible beam is, of course, emitted from an H2S scanner. In this "Flight" copyright picture, our artist has*

FLIGHT COPYRIGHT

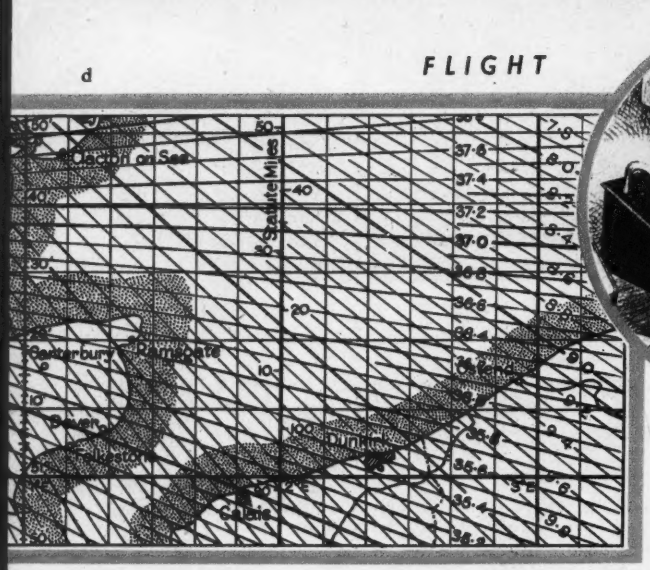
Components of the blind bombing equipment installed in the navigator's compartment. The main indicator unit with Plan Position Indicator is seen in the centre. Inset, is an impression of the P.P.I. display showing the range circle and course marker.



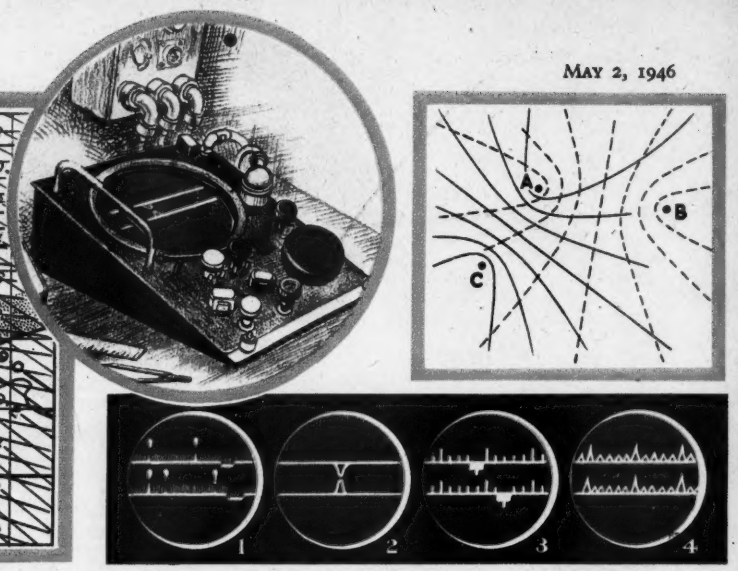


given an impression of the search area covered by the scanner of the blind-marking equipment, and of the corresponding display (in circle) produced on the fluorescent screen of the cathode ray tube. Green, red and yellow T.I.s were all used for ground marking. On some daylight tactical raids by heavy bombers, target indicators generating coloured smoke were used by the Pathfinders.

LIGHT COPYRIGHT



Gee depends upon the measurement of the time difference between the reception of synchronized pulses from a master, A, and two (or more) slave transmitting stations, B and C, transmitting in the order A, B, A, C. On a Gee lattice chart B position lines are printed in blood red, C in sea green, D in deep purple. A, the base reference, is not represented on the chart.



In the four small circles are indicated stages in taking a Gee fix. (1) The main A signal is seen, top left, with the second A and its identifying ghost below it. Both are adjusted to the fix position on the main time base. B and C signals are upper and lower centre respectively. (2) B and C are centralized on the strobe time base on which they will appear after they have dropped into the strobe steps (right in 1). (3) and (4) Coarse and fine scales for the reading of B and C co-ordinates. C (or D if used) readings in (3) commence on the upper line from 30, and B is on the lower line, starting from zero.

solitary pioneers. Nevertheless, night after night Whitleys and Hampdens droned slowly out over the East coast and, either singly or in small forces, attacked the enemy as best they could. The very act of flying to the target and back to base at night, often in bad weather, was in itself very hazardous, as casualty figures showed. Clearly, as more and better aircraft were produced, and crews began to trickle from the training schools, some new plan of attack had to be developed if an effective night bombing offensive was to be mounted.

Equipment Improves

Towards the end of 1941, certain aspects had begun to look brighter. Lessons learned the hard way had supplied a mass of information with regard to difficulties experienced, types and effect of enemy defences, and faults and deficiencies in our own aircraft. From this material, and from intelligence sources, enough was known to enable tactics to be revised to take the best advantage of enemy weaknesses. Aircraft and engines, no longer in such desperately short supply, were improving, and their ceiling and bomb load were increasing. Even more important, factories were beginning to provide all kinds of sorely-needed instruments, the design, perfection and production of which had proved such a tremendous task for the scientists.

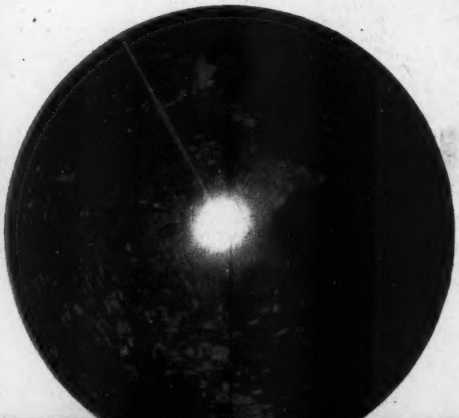
Passing to the second stage of bombing, or analogy No. 2, navigation was still of crucial importance, for not only had each aircraft to reach the target but, as the force increased in size, some accurate system of timing was essential. Obviously, large numbers of aircraft could not be allowed to continue to straggle across enemy territory for long periods after the enemy night fighters had discovered the route and target. Equally obviously, a great deal of confusion would be liable to occur if aircraft from various directions were allowed to arrive more or less all together at a target.

Navigational methods had improved a great deal during the first year or so of the war. Dead reckoning, aided by radio bearings and occasional visual fixes, were the basis of position keeping. Astro fixes were little used, due to bad weather, the impracticability of flying straight and level for minutes at a time, and the fact that most of the young mass-produced navigators lacked the experience required to give reasonable accuracy.

Aerial Lighthouses

Over home territory both normal and emergency identification of position had been aided greatly by the provision of a network of red or white air lighthouses known as "Pundits" and "Occults," and by the introduction of "Darky" listening watches on short-range radio posts all over the country. Co-operation with searchlight batteries *via* colour signals and, finally, aid from the Royal Observer Corps, was also important.

The introduction of "Gee," a semi-radar grid navigational system was another important milestone on the way to a successful night-bombing offensive. First used against Cologne on May 31st, 1942, this ingenious device might be described as the "navigator's navigator." For the first time,



As a navigational instrument H2S is completely self-contained. Features such as Flamborough Head can be readily identified. The P.P.I. covers the

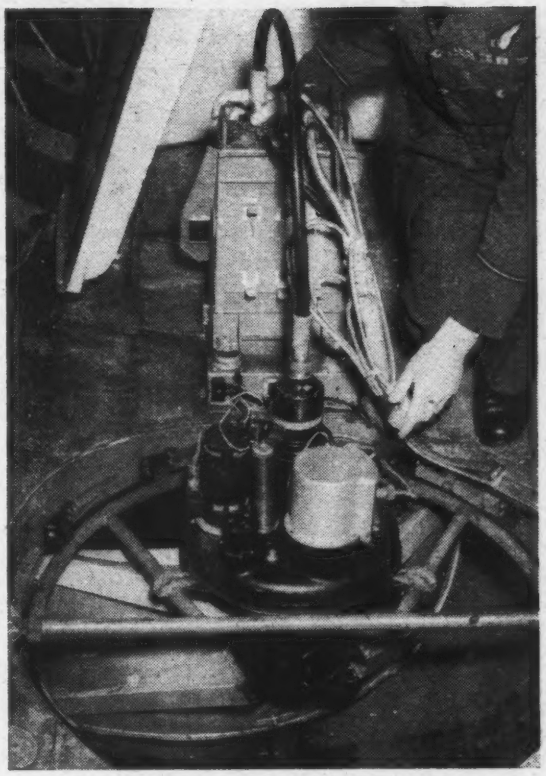
regardless of visibility, and with hardly any knowledge of his whereabouts, a navigator could obtain an accurate fix of the position of his aircraft at a minute's notice and without the direct aid of crew or ground operators. The instrument is complicated (there are 30 valves and a cathode-ray tube), expensive and rather heavy (120lb), and operates in conjunction with fairly extensive ground installations which require tall aerial masts. Other weaknesses were the relatively short range (approximately 300 miles at 10,000ft), and the reduction in signal strength and range at low altitudes. The set cannot be used for any other purpose than its primary one of Gee navigation. However, Gee proved quite reliable, suffered from few operational faults and, as new territory was taken, more ground stations could be built and more chains introduced to increase the area of coverage. Indicative of its importance to and acceptance by bomber crews is the fact that at one time steps had to be taken to prevent a drop in the standard of "straight" navigation due to the growing practice of "Gee stooging" (i.e., depending entirely upon a series of Gee fixes for navigation).

Pathfinder Conception

The change from stage No. 2 to stage No. 3 was gradual and depended upon crew teamwork in its widest sense. Only the highest standard of co-operation between individual aircraft and squadrons, and the most skilful flying, navigation, bomb-aiming and application of special equipment could produce the results which were the goal of Bomber Command.

In an endeavour to find methods for improving striking power, the Command addressed a questionnaire to the young veterans then operating, and from the many suggestions received emerged one which was almost unanimous: the need for a force of pathfinders.

It was known that just as in every trade some excel, so on bombing missions were there certain crews which, in spite of all difficulties, seemed to be able consistently to find and bomb their target. It was felt that if a number of these successful crews could be collected together into a single unit with the special duty of locating the target, and in some way guiding others to it, attacks would be much more effective. To post the best crews from their squadrons to take part in what amounted to an experiment was neither an easy nor a popular move. However, Officers Commanding soon realised that first-class pathfinders would mean success for the whole force, and by selection (or in some cases on a voluntary basis) a number of crews were finally gathered together, and Pathfinder Force came into being. In each case a crew as a unit was chosen, for it is not an individual pilot or navigator who brings success, but the team—although of course, good captaincy is an essential of a good crew.



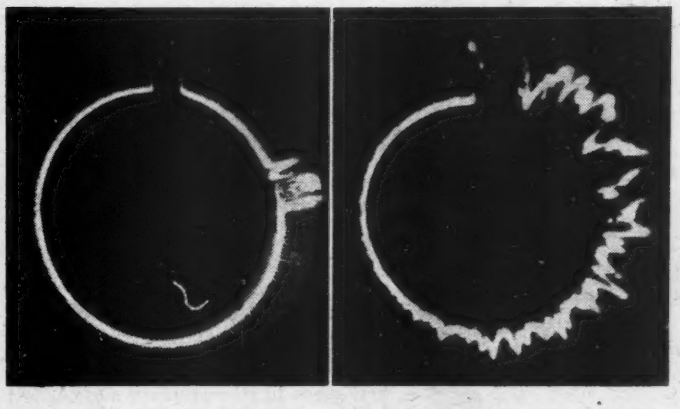
The inside of the bulge. Covers have been removed inside the fuselage to expose the H2S scanner unit.

The First P.F.F. Attack

In August of 1942, a Pathfinder Force trained on Lancasters was ready for action and the first Pathfinder-assisted attack was made against Flensburg on August 18th. The primary job of the Pathfinders was positively to identify the target, and to mark it in such a way that the Main-force aircraft, following on behind with their explosive or incendiary loads, could fly-in and aim their bombs at the point marked, without any regard for other ground detail. Complete reliance was placed on the Pathfinders and should they fail then normally the whole attack would fail.

The first Pathfinders, then, were the pick of the experienced bomber crews who had proved their skill and ability by results achieved. They were no more courageous than Main-force crews, but they did at first face rather greater risks in view of their exposed position as the spearhead of an attack, and because they had to remain for a longer period, and sometimes at a lower altitude in the heavily-defended target areas.

The original plan was simple, straightforward and somewhat crude compared with the technique developed during the succeeding months. It met with but limited success, and the port of Flensburg received only small damage. The Pathfinders did two jobs on this occasion: the first crews found the target and dropped lines of illuminating flares across it; then, by the light of these flares, more crews identified details of the port and dropped T.I.s (target indicators) to mark an aiming-point. This simple visual technique was employed and developed during the ensuing months, and much was learned about the con

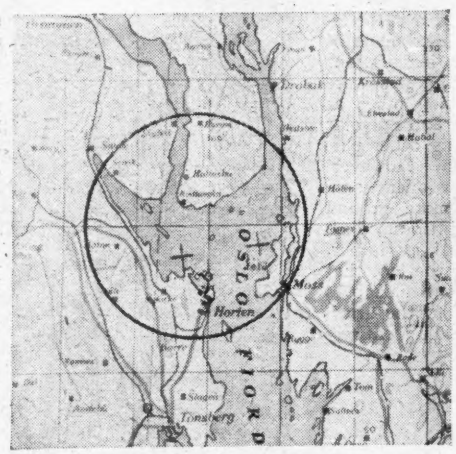


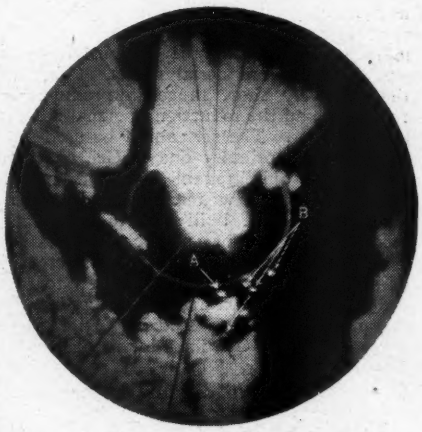
The effect of "window" jamming on enemy radar detecting and fire control devices. An aircraft coming in at about "3 o'clock" would normally produce a single well-defined "blip," as shown on the scale in the left-hand photograph of a Wurzburg screen. The photographs are taken from a German instructional film.

PATHFINDER STORY (CONTINUED)

trolling and timing of large forces of heavy bombers on night missions.

The next great step forward came with the introduction of radar bombing aids, the first of which was known as "Oboe." (Incidentally, the term radar—"radio detection and ranging"—is a handier American adaptation of the former British term "radio direction-finding.") Oboe was a blind-bombing device, quite unaffected by normal visibility, cloud, fog or bad weather, and in the hands of experienced operators and aircraft crews, it would permit extremely accurate results. Its first use was against a power station at Lutterade, on December 20th, 1942. Oboe opened up many new possibilities and was in regular use until the end of the war. Its chief limitation when it was first introduced was its range, which was comparatively short at the operational altitude of contemporary bombers, though it was extended later when used in conjunction with Mosquitoes operating at altitudes up to 30,000 feet. (An illustrative diagram is inset in the double-page coloured drawing.)





This P.P.I. photograph is of special interest as it reveals the cruiser Köln and other shipping lying off Horten in the Oslo Fiord. A indicates the Köln, and B, other large ships.

The Principle of Oboe

Two fixed stations were used for Oboe, known as the tracking or "cat" station and the releasing or "mouse" station. Each had pulse-transmitter, receiver and range-measuring equipment while the aircraft carried only a transmitter-receiver. Pulses from the fixed stations, received and retransmitted by the aircraft, were picked up again by the ground stations and the total time of travel since transmission was measured. The distance of the aircraft from each station was therefore known at any time, so the position lines were circles with the station at the centres. The two stations pooled their range readings and transmitted their result to the aircraft in the form of a fix.

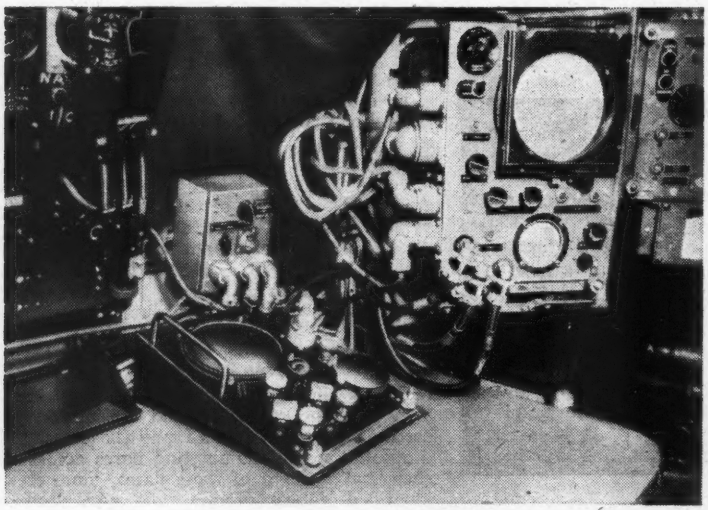
The Oboe Beam

For blind bombing or marking, the aircraft required only to reach a predetermined position; to do so, the pilot flew by normal navigational methods to a point on the desired position line of the "cat" station, and then switched on his Oboe. The aural signals of the Oboe beam were similar to those for S.B.A. (Standard Beam Approach), namely E's and T's in Morse which produced a continuous note in the overlapping zone of the beam. Any deviation from the position line of the tracking station was indicated by the continuous beam note breaking up into E's or T's. Very accurate flying was required to hold the beam, which was only 17 yards wide.

As the aircraft continued along the beam, "distance from target" signals were received at eight, five and three minutes' time to target, and were in the form of four morse Bs, Cs or Ds respectively. At five seconds from the release point, five half-second pips were heard, followed by a 2½-second dash, the finish of which marked the moment for bomb release.

During the run-up to the target, for as much as the final fifteen minutes, a great deal of strain was experienced by the pilot, who not only had to hold the beam accurately, but also had to fly at constant height and fixed air speed, regardless of his greatly increased vulnerability to predicted flak. At base, to enable the bombing or marking run to be examined, and the accuracy assessed, a graphic record of the course of the aircraft was produced automatically from signals returned to the releasing station. Among the chief advantages of Oboe in addition to its great potential accuracy, was that all calculations could be made in advance, and that the observations were made in relative peace and comfort at base stations.

Another radar blind-bombing and navigational aid was introduced for the attack on Hamburg on January 30th, 1943. This instrument, known as H2S,



The navigator's compartment on a Lancaster, showing the Gee unit let into the table, and the H2S on a tubular mounting which is hinged in the horizontal plane.

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Tensile Strength (lb./sq. in.)	27,000	7,000	12,000
Compressive Strength (lb./sq. in.)	65,000	34,000	42,000
Shear Strength (lb./sq. in.)	18,000	11,000	15,000
Cross-breaking St'gth (lb./sq. in.)	29,000	14,000	19,000
Impact Strength (ft./lb.)	5	2.5	4
Fatigue Strength (tons/sq. in.)	3.75	1.0	2.25
Density (Gm./c.c.)	1.87	1.67	1.74

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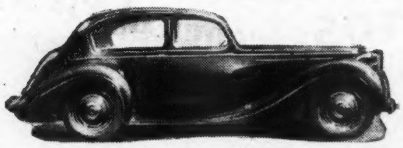

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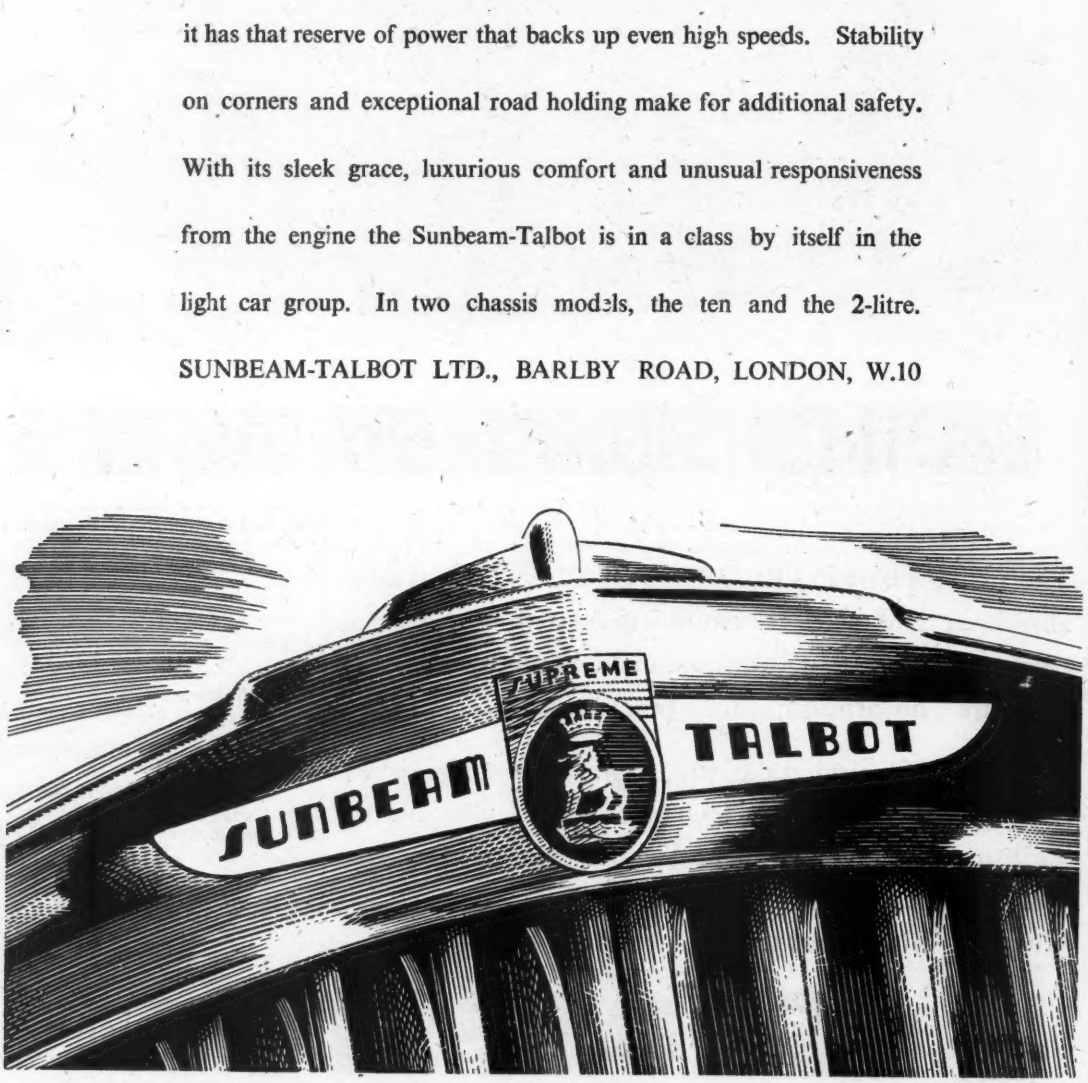


A PRODUCT OF THE ROOTES GROUP

PATHFINDER STORY (CONTINUED)

was also used on the majority of subsequent attacks, including the later series directed against, and resulting in, the destruction of Hamburg.

Closely related to A.S.V. (Air to Surface Vessel)—which was the first airborne radar device, and which was demonstrated during fleet manœuvres in September, 1938—H2S gave bomber crews a new sense in the form of vision at centimetre wavelengths through darkness or cloud for bombing, marking or navigation. The H2S aerial or scanner unit was mounted in a blister below the mid-upper turret of a Lancaster. The aerial and reflector were caused to rotate by an electric motor at approximately 50 r.p.m. and the radial time base of the P.P.I. (Plan Position Indicator) went round in synchronism with them. The echoes received, according to intensity, brightened portions of the cathode-ray tube, giving a facsimile reproduction of the landscape features below.

Like A.S.V. for submarine detection, it became apparent in 1943 that H2S could act not only as a "magic eye," but as a warning to the enemy of the presence of the bomber carrying it, and that the pulses transmitted by some early marks of equipment could be picked up by enemy night fighters, and used for homing on to the bomber. H2S had the advantage of being self-contained in the aircraft, and therefore independent of range from base and of ground organization, but a high weight penalty of approximately 700 lb had to be paid. Skill and practice in operating the set and in interpreting the representation it gives are essential for good results, and a great responsibility rests upon the H2S operator of a P.F.F. crew.

Crews of No. 8 Pathfinder Group, in the later stages of the war, were mostly selected as soon as they left their final crew-training unit, and from then onwards their special training in their squadrons and at the P.F.F. Navigational Training Unit filled all available time before operating and between operations. In some cases they were attached to a main-force squadron for a few familiarizing trips. Their aircraft, Lancasters in the main, contained all the latest navigational instruments and the most recent marks of H2S or Oboe, which were the basic target-marking instruments. The exact technique changed in detail from day to day, but the fundamental job of providing a marked point on which all bomb-aimers could release their loads remained unchanged.

Efforts to Improve

Every possible effort was made to improve technique and bombing accuracy both in Pathfinder Force and in the Main-force squadrons. For example, all aircraft were fitted with automatic cameras and photo flashes, and a series of photographs were taken of the bombs or pyrotechnics as they were released and as they fell. Prints showing ground detail could then be used to plot the point of impact of the bombs. After raids, an assessment or post-mortem conference was held to discuss every aspect of the operation: also, of course, each crew, first thing after landing, was interrogated over a cup of coffee by intelligence officers, and the captain was invited to give his views on the attack as a whole. Between operations, inter-crew, squadron and group competitive training also played a very important part, and athletic events of all kinds were arranged to keep the crews physically fit.

Crews were graded according to their prowess, the most skilled being the Primary Blind Markers. During training on operations, crews served as "supporters" who went in with the early waves of markers, and took photographs (later to be checked for accuracy of position) instead of dropping target indicators. Frequently they also dropped a load of high explosives with long-delay fuses so that they could feel that their trip had not been unproductive. Their main extra duty on the attack, as signified by the name, was to support the Primary Markers by releasing "Window," the silvered strips dropped in small clouds, at a predetermined rate, to jam the enemy radar detecting devices. This meant that instead of receiving the full concentration of predicted flak at the target, due to their exposed spearhead position, these first important waves had some protection and company.

Other duties of the Pathfinders were blind and visual illumination by the Flare Wave crews, visual marking, and visual backing-up (renewing) of primary target indicators. This included the centring technique whereby specially trained bomb-aimers were able quickly to assess the mathematical centre of a number of T.I.s visible on, say, a city, and to aim at this estimated position their T.I.s of a different colour, to provide a central main marking point.

As accuracy of bombing and marking improved, and bomb loads for all Main-force aircraft reached the order of five tons or more, it was found that two hundred aircraft could do the damage previously expected of five hundred, and only the very largest enemy cities required the attention of our total strength. It therefore became customary for two or even three smaller forces to operate separately, and P.F.F. commitments were thus increased. No. 5 Group of Bomber Command, in particular, operated separately on almost every occasion, and one Mosquito and two Lancaster Pathfinder squadrons were incorporated in the Group to look after its special marking requirements.

Methods of Marking

Target marking methods for night bombing are of particular interest, and the ultimate aim of Bomber Command was to be able to attack a target regardless of weather conditions. Blind-bombing instruments made it possible to find the target, but marking it was not always a simple matter. In clear weather, marking on the ground was satisfactory, but, with cloud present, parachute flares were required, and these not only descended slowly, but drifted, and so continuous backing-up (re-marking) was needed during an attack if anything like an accurate aiming point was to be provided over the target.

A number of code words were used for the various attacks, according to the type of marking in use. "Paramatta" was one method of blind ground marking, with H2S as the blind-marking instrument. "Newhaven" was also ground marking, but included illumination by flares, and visual identification of the aiming point. When Oboe was used as the initial blind-marking instrument, the attacks were qualified by the prefix "Musical," e.g., "Musical Paramatta." Lastly, when sky-marking was used, a "Wanganui" attack took place.

The concluding instalment of "Pathfinder Story," dealing with target indicators, marking of small high-priority targets, the duties of the Master Bomber, and enemy reaction will appear in next week's issue dated May 9th.

R.Ae.S. HATFIELD BRANCH RE-FORMED

THE Hatfield branch of the Royal Aeronautical Society, which was first formed in 1939 and whose activities had to be suspended on the outbreak of war after only two meetings, is being re-formed, and a committee has been elected to arrange a full programme of lectures, visits within the industry, and informal discussions.

Early in 1943 Mr. R. E. Bishop, the de Havilland chief designer, was mainly responsible for the formation of the D.H. Engineering Society which, during the past three years, has arranged 47 lectures and 24 visits for technical personnel of de Havilland and other firms. This Society will now be merged in the revived R.Ae.S. branch at Hatfield, of which Sir Geoffrey de Havilland is president and Mr. R. M. Clarkson, the de Havilland assistant chief engineer, the new chairman. The name of the D.H. Engineering Society, however, will be retained by the old society's planning section, which is to continue its work for the firm's production side.

CIVIL AVIATION

IMPROVED ATLANTIC SERVICE

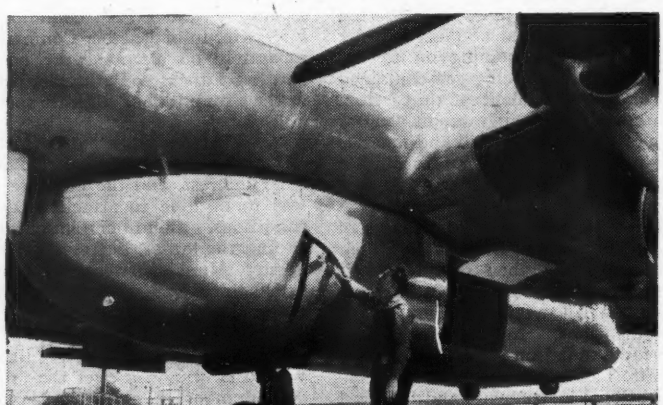
TRANSATLANTIC flights made by Trans-Canada Air Lines have now been increased to four per week. Lancastrians leave Prestwick on Sundays, Mondays, Wednesdays and Fridays for Montreal, and on a normal flight there is accommodation for ten passengers and 3,500lb of mail, express and baggage.

Half fares are now available for children between two and twelve years old accompanied by a passenger aged twelve or over.

INCREASED COMMERCIAL TRAFFIC

OF the passenger traffic handled on B.O.A.C.'s Empire and European Division services, some 80 per cent. is now commercial; the remainder consists of Government and Service passages. B.O.A.C. has announced a considerable increase in air bookings by industrial firms for their overseas representatives, and the Passenger Bookings Branch in London is handling over a thousand telephone enquiries and requests for reservations on aircraft every day.

Many passengers, however, who wish to travel on the Empire and trunk line air services still do not seem to appreciate that their applications must be sponsored by an appropriate Government department who forward requests for air passages to the Air Priorities Board for approval. Similar restrictions do not apply on the European services, where only a percentage of accommodation is reserved for priority traffic.



EXCRESCENTIAL: In order to take advantage of the possible load-carrying capacity of the somewhat slim-fuselaged Constellation, an "overload" freight compartment has been devised. This can carry four tons, and is quickly removable, but lowers the cruising speed by about 10 m.h.p.

FREE AIR

THE first step in freeing the air for civil aviation generally has been made by the Government of Portugal, which has abolished all prohibited flying zones over its territory. An announcement to this effect was recently made by Dr. Warner, the President of the Interim Council of P.I.C.A.O. Commenting on Portugal's action, he said that it represented a progressive step forward in removing barriers to international civil aviation.

COMBINED OPERATIONS?

DURING a lecture on "Ocean Transport" which he gave before the Institute of Transport on April 8th, Mr. P. Maurice Hill, the general manager of the Chamber of Shipping of the United Kingdom, said that although the future development of air and sea transport would necessarily be closely linked, participation in the development of air travel and in the possibilities of air freight had been denied to surface transport, whether sea or rail. Even the nominal admission of sea and rail interests to air chartering or taxi services had been made worthless by the threat of competition from all-powerful State monopolies.

The Government, when announcing its policy, had said that it would seek the co-operation of surface transport with air transport, continued Mr. Hill, but, so far, no steps appeared to have been taken. Neither the shipping industry as a whole nor individual shipping owners had been approached, either by the Government or B.O.A.C. He suggested that there was no difficulty in making arrangements for the co-ordinating of routes and services, or for through bookings or interchangeable tickets between two forms of transport. There should be a future for combined sea and air transport. The difficulty would be to bridge the initial period when the volume of traffic would be inadequate, but trade should follow transport, and such combined travel facilities, even if maintained at a loss to begin with, would prove the most powerful means of opening up new trade and travel throughout the Empire and world.

APPOINTMENTS TO B.O.A.C. . . . .

THE appointment of two new members to the B.O.A.C. Board has now been announced by the Ministry of Civil Aviation. They are Lord Rothschild and Mr. H. L. Newlands. The former is taking up a technical post, and the latter will be concerned with labour relations—doubtless in replacement of the vacancy on the board caused by the recent death of Mr. John Marchbank.

Lord Rothschild is 35, and is well known in scientific circles. During the war he served with the Army Intelligence Corps, receiving the George Medal in 1944 for work on bomb disposal, and also the American Army Bronze Star and the American Legion of Merit. Mr. Newlands, who is 48, is a former branch secretary of the Transport and General Workers' Union. He has held official appointments as Labour Inspector under the Ministry of Labour and National Service, and also with the Ministry of War Transport. In 1941 Mr. Newlands was appointed National Labour Officer of the National Dock Corporation, and he will continue in this appointment until he takes up his new post with B.O.A.C. on May 18th. He was awarded the M.B.E. this year.

. . . . TO P.I.C.A.O.

FOUR more of P.I.C.A.O.'s Secretariat posts have been filled with the appointments of Lt. Cdr. Neil Richardson, R.N.R., as Chief of Regional Organization; C. L. Cade (U.S.A.) as Chief of Personnel; K. E. Lohse (U.S.A.) as Expert with the Aeronautical Maps and Charts section; and Flt. Lt. M. A. Bierens de Haan (Netherlands) as Analyst to the Air Transport Bureau.

Lt. Cdr. Richardson represented Imperial Airways in Canada, Newfoundland, and the United States, before the war in connection with the organization of North Atlantic flying-boat services. During 1940-1941 he was in charge of all Imperial Airways flying-boat operations from the U.K. and later went to Canada and the U.S.A. to investigate operational facilities and to study the organization of Trans-Canada Airlines. He was appointed Superintendent of Routes for B.O.A.C. and, later, Chairman of the B.O.A.C. Aerodrome Committee. He was also a member of the Air Ministry Aerodrome Advisory Mission to the Middle East and South African Air Conference.

. . . . AND TO INDIA

THE development of India's civil air transport services has called for an expansion in the Civil Aviation Office of the Government of India. Three new appointments at Delhi have now been filled by specialists from England. They are Air Vice-Marshal Sir Edward Rice, K.B.E., C.B., M.C., who has become Deputy Director-General of Aircraft, Air Commodore E. I. Bussell, C.B.E., who has been appointed Director of Licensing, and J. P. Jeffcock, who is now Director of Communications.

Sir Edward Rice served with the R.F.C. and the R.A.F.

for 32 years. During this war he was with Bomber Command, and in 1941 went to West Africa to organize air reinforcement to the North African Forces. After the European war had ended he commanded a Training Group engaged in training crews for the war with Japan. Air Commodore Bussell served for five years at Air Headquarters, India, and was to a large extent responsible for the enrolment and training of personnel for the Royal Indian Air Force. Mr. Jeffcock has, for many years, been engaged in the development of radio communications, and during the war in radar development. He was a member of the Civil Aviation Radio Advisory Committee to the Ministry of Civil Aviation.

MERLIN ACHIEVEMENT

THERE can be few corners of the Commonwealth or Empire where Rolls-Royce products are not to be found, but it is even more noteworthy that at the present time all the Empire air routes are being operated by aircraft using Rolls-Royce engines. Services to India, Australia, South Africa, and South America, and also the T.C.A. transatlantic services, are all flown with Rolls-Royce engined aircraft, and although these aircraft are interim types mostly developed from military machines, the speed and reliability of the schedules which they are operating are being constantly maintained.

SOUTH AMERICAN SURVEY

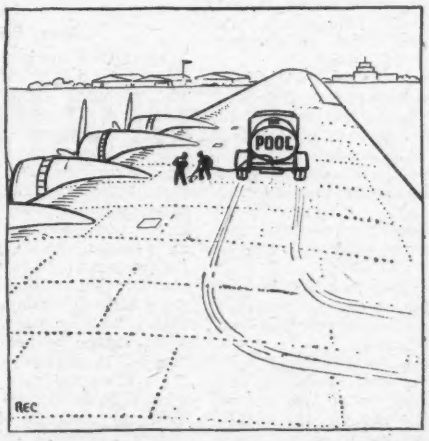
WHEN the British South American Airways Lancastrian aircraft *Star Land* flew from London airport on April 22nd to South America in order to survey routes across that continent, it set up a new record for the flight from London to Buenos Aires, flying to an accelerated schedule. The aircraft was commanded by Air Vice-Marshal D. C. T. Bennett, Chief Executive Officer of B.S.A.A.

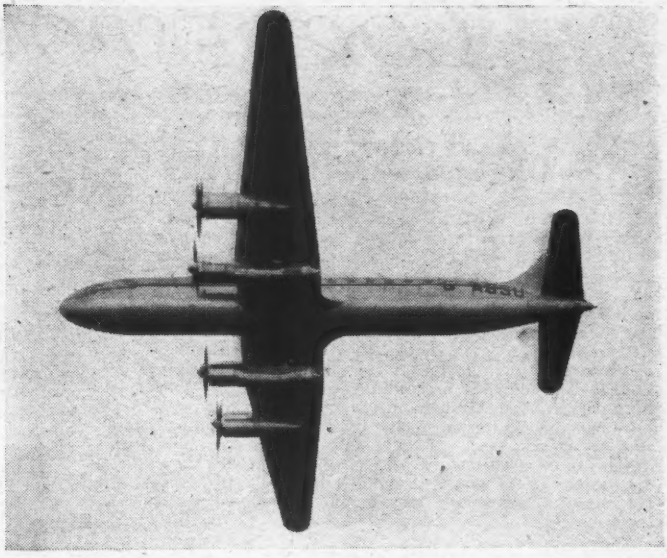
The survey which he is undertaking of South American routes included a flight over the Andes, which were crossed at 23,000ft without incident, to Santiago; thence on to Lima in Peru; to Bogota the capital of Colombia; Caracas in Venezuela; and finally to Trinidad, returning home via Natal and Bathurst. At each port of call talks are taking place with Government officials regarding the extension of the B.S.A.A. route, and it is understood that already a satisfactory discussion has taken place in Santiago.

THESE (DIS)AGREEMENTS

LAST week an announcement was made of the approval in principle by the Egyptian Cabinet of an agreement to form an Anglo-Egyptian company with a capital of £250,000 to operate air services between U.K. and Egypt, and on to various other parts of the Middle East. This "approval in principle," however, is still subject to Egyptian Parliamentary sanction. It has also been announced in America that discussions on civil aviation, on the lines of the Bermuda talks, are to take place between the United States and Russia.

In spite of all these signs of promise, however, the position with regard to air agreements becomes more and more involved each week, and there is clearly a good deal of "behind-the-scenes" uneasiness. In last week's issue we mentioned the domestic contretemps in the U.S. regarding the legality of the various civil aviation agreements concluded by the State department. Now a problem has arisen over a proposed contract between Trans World Air Lines of America and the Italian Government whereby the former would obtain almost exclusive rights to operate internal air services for the latter through the formation of an Italian-American airline company. To this, the British Government has not unnaturally objected, and has requested that British European Airways should be given an interest in any such concern. It is understood that the U.S. State Department is, up to a point, in sympathy with the British objection, but the whole problem seems now to have entered subterranean diplomatic channels.





TUDOR PLAN: The narrow-chord tapering wing of the Tudor II gives it, in plan view, a somewhat more graceful appearance than might be expected in such a relatively large-capacity civil transport.

BREVITIES

Galway Corporation is making an application to the Eire Department of Industry and Commerce for the use, as an airport, of land at Oranmore about six miles from the city.

* * *

The Vice-Chairman of the United States Civil Aeronautics Board is now Mr. Oswald Ryan. He was first appointed to the C.A.B. in 1938, and he was a member of the U.S. delegation to the recent Bermuda Conference.

* * *

An agreement signed in Budapest at the end of last month between the Soviet Union and Hungary provided for the formation of a joint Soviet-Hungarian Maritime Association and a joint Civil Aviation Association.

* * *

Regular services between Bombay and Calcutta have now been put into operation by Tata Air Lines of Bombay. The routes operated by the company are now, therefore, from Bombay to Karachi, via Ahmedabad; to Delhi via Ahmedabad; to Colombo via Hyderabad and Madras; and to Calcutta via Nagpur.

* * *

To enable passengers on their "East Indiaman" service to embark at a more convenient hour in the morning, Indian National Airways aircraft to Calcutta will now leave Delhi at 6.30 a.m. Dakotas are used and they call *en route* at Cawnpore and Allahabad. Accommodation for non priority passengers is available on these aircraft.

* * *

A three-thousand-mile Soviet arctic air route, from Krasnoyarsk in Southern Siberia, via Yakutsk and the Bay of Lavrenty, to the far north shores of the Bering Straits, which was started during the war, is said to be specially equipped for arctic conditions so that services, including regular night flying, can be continued throughout the year.

* * *

Short Sunderlands converted for civilian use are to be used by two more South American airlines. One of them is the Compania Aeronautica Uruguaya, S.A., and the other is Corporacion Sudamericana de Servicios Aeros, S.A., of Buenos Aires. The third South American airline company, which already has four of these flying boats, is the Dodero Company of Argentine.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

R.A.F. VICTORY PARADE

Veteran Aircraft Types That Made it Possible

THE programme for the R.A.F.'s fly-past in the Victory Parade on June 8th, which was announced in the "Service" section of *Flight* last week, mentions a number of aircraft types which will be taking part. I notice, however, that these are all modern types, and that no mention is made of any of the 1939 veterans, such as the Hurricane, Wellington, and Swordfish, but for whose gallant service the Victory Parade might never have been possible.

It may well be, of course, that the authorities have not overlooked them and that it is intended to give them an honoured place in the proceedings, but just in case they *have* been omitted from the parade, I should like to put in a strong plea that they be included, and I feel sure that many of your readers—especially ex-Service "boys" who flew some of them in those desperate days of 1939-40—will support the suggestion.

It would obviously be difficult to have a "Stringbag" in the same formation as a Meteor, but there could surely be a special section for the veterans. OBSOLETE.

REWARD FOR SERVICE

"Ex-Brats" Deserve Better Recognition

"WING Co." Rtd. has certainly summed up the lot of the ex-aircraft apprentice with extreme accuracy. I am one of those "ex-brats" who after some 18 years of undistinguished but nevertheless hard service at last reached the officer's mess. Four years as commissioned engineer officer made me realise that our initial training and our long experience in times of peace had not been wasted.

There is no doubt that without the ex-Halton or Cranwell boy the amazing and rapid expansion of the R.A.F. in the years immediately preceding and during the war could never have taken place.

Our chances of success in "civvy street" are pretty meagre as I and, no doubt, a whole lot more are finding to our cost. Is it too much to ask that our training and years of experience on aircraft be given some sort of official recognition that would carry some weight with a civilian employer?

All I have to show for 22 years service is a piece of paper giving length of service in the ranks, with dates and ranks held as a commissioned officer, and in the remarks column the words "Adverse Reports—Nil."

"EX-BRAT" RTD.

"Trenchard's Boys Should be Dispensed With . . ."

FOLLOWING on the remarks by "Wing Co." in *Flight*, April 18th, regarding ex-aircraft apprentices, there is a lot more to be said on this subject. Having just ended my long-extended period of service as a tradesman in the R.A.F. I should like to air some views which, I have no doubt, are those of many of my fellow ex-boys.

Boys of good secondary or technical education are asked to join the R.A.F. and receive training in a highly skilled trade and receive pay while under training. This sounds very tempting to parents and very soon "our Willie" is wearing a suit of blue with a coloured band round his hat.

No information is given as to what happens after training—that having passed out A/C1, as about 80 per cent do, after 18 months he will become L.A/C. and from then on has no hope of further advancement for some seven years; after which time he will be promoted to the highly lucrative and important rank of corporal in which he will have the honour to serve for at least three years before he can hope to take another step up the ladder.

By this time he will have completed his "first twelve" and will calmly be asked if he wishes to be considered for a further period of twelve years' service.

Of course, being a man of initiative and ambition he can only refuse this offer. It, however, after so long in sheltered and secure Service life he has taken on the appearance and attributes of a fish, he will probably sign on.

Parents must be made to realise that a career in the R.A.F. is a military career and every man is first a soldier and secondly a tradesman. People should not be allowed at the age of 16 to tie themselves to a Service life for which they may, when they are about 22, find themselves entirely unsuited.

Trenchard's boys should be dispensed with and the technical training of boys should be undertaken by the Ministry of Education, so that no military service will feel it is obliged to keep people for long periods because of the original outlay for training. N. BRITTON.

PICKING THE WAR-WINNERS

Which Aircraft Had the Greatest Share in Bringing Victory?

ALTHOUGH aware that this is a very controversial subject, I think it would be interesting to know which Allied aircraft are considered by your readers to have played the greatest part in winning the war. My own list (in alphabetical order), with reasons for selection, is given below. I have named eight aircraft, since I consider a smaller number would exclude some of the greatest machines.

(1) Dakota—for transporting and supplying the Allied Armies.
(2) Fortress—for its precision day-bombing of Germany.
(3) Hurricane—for winning the Battle of Britain.
(4) Lancaster—for its splendid work in Bomber Command.
(5) Mosquito—for versatile service as a bomber, fighter and P.R. machine.
(6) Mustang—for long-range escort work.
(7) Spitfire—for maintaining Britain's fighter supremacy throughout the war.
(8) Typhoon—for close support over France and Germany.

PROVOCATEUR.

R.Ae.C. LIBRARY

Books of Historical Interest

I DOUBT whether the aviation world appreciates in full the tremendous degree of British pioneer work in the early days of flight. Recently I read a book, published in 1838, in which the following information appeared:—

"Up to 1837 there were in the world 471 'aerial voyagers.' This included 313 English, 104 French, 18 Italian, 17 German, 5 Turkish, 3 Prussian and 3 U.S.A. Of the grand total, 49 were women; and of these 28 were English, 17 French, 3 German and 1 Italian. By this date there had been nine victims of aerial navigation—five in early fire balloons, and one incredibly stupid accident made by Lieutenant Harris, R.N., who was taking a girl friend for a jolly on May 25th, 1824."

This book, of absorbing interest, has just been presented to the Royal Aero Club library by Mr. Griffith Brewer. Many other gifts of books have been made to the library. As the Club's Honorary Librarian, in association with Mr. C. H. Gibbs Smith, I should like to remind those with books of historical aeronautical interest—especially those with records of squadrons now dispersing after the recent war—that the Royal Aero Club would be happy to be the permanent custodian of such chronicles. B. J. HURREN.

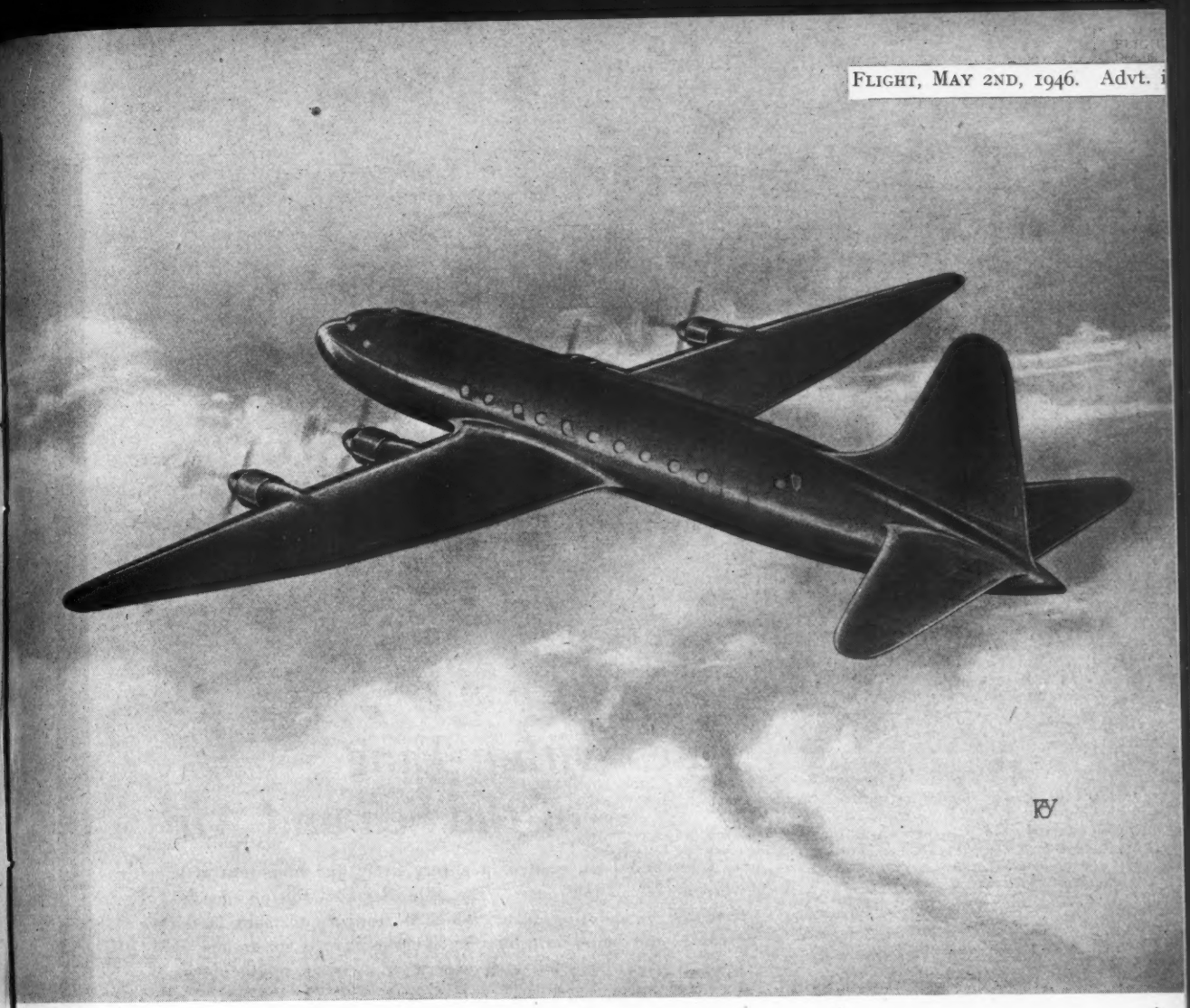
FUEL AND WEIGHT

Ram Effect and Air Temperature

READING the replies (*Flight*, April 18th) to "Mixture's" letter (*Flight*, March 28th) on the above subject, I feel that I should submit evidence in support of the opinion of "Mixture's" flight engineer leader, who has not been defended up to the present.

On analysing the results of speed and fuel consumption tests on a Warwick C.R. Mk. V fitted with Centaurus VIIs and Stromberg carburettors, I was puzzled by the fact that, for the same manifold pressure and r.p.m. settings, the fuel consumption decreased by an average of approximately 3 per cent. for an average aircraft weight reduction of 15 per cent. This became apparent as a result of a large number of meticulous comparative readings taken from gallons-gone meters on the same aircraft during the same flight at two different weights and at the same height and air temperature. I had therefore every reason to believe in the accuracy of these results and was led to conjure up the following explanation.

At given r.p.m. and manifold pressure settings a reduction of weight results in a greater i.a.s. and greater ram effect. With an adiabatic compression in the air intake, the greater ram will lead to a greater temperature rise of the incoming air.



HERMES

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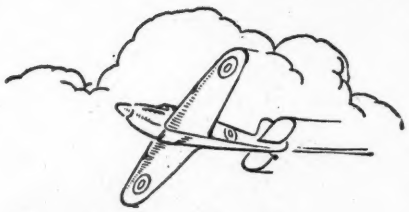

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by 'FOUGUEUX'

of *The Aeroplane*

Tales with a Tang of the Sea and Air

This is a book written in a very lively and humorous style with never a dull page. The title *Second Dog* is derived from the Second Dog Watch which is from six to eight in the evening—the hours in which it is customary to sit around at the end of a day's toil and, over a drink or three, to gossip, chat and yarn.

Here then, is a collection of Ward Room tales with an aeronautical flavour. *Second Dog* may be regarded as a sequel to *No Specific Gravity*, which concentrated mainly on the naval aviation side, whereas this book embraces naval, political and journalistic anecdotes and episodes, the majority of which have not been recorded before. The stories can be vouched for by the author, B. J. Hurren, who is a regular contributor to *The Aeroplane*, writing under the name of "Fougueux." *Second Dog* makes a good companion for a railway journey or to have on your bedside table. Order your copy today.

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CORRESPONDENCE

This increase of temperature should still be present after an isothermal pressure drop across the butterfly, after fuel vaporization cooling and after compression heating through the supercharger. The charge temperature would therefore increase while the manifold pressure remains constant (controlled directly) and this would result in a smaller air weight consumption.

The Stromberg carburettor of the Centaurus VII, as well as the Ceco carburettor of the Twin Wasp on the B24, is compensated to maintain a constant air/fuel ratio by weight with variations of air temperature. The smaller air weight consumption would therefore result in a smaller fuel consumption.

If this pours more oil on the fire of the argument, I hope that someone with "expert" knowledge of the subject, or perhaps with reliable test data on charge temperatures, will be coaxed to substantiate or disprove my theory. In the meantime "Mixture" might reflect that the "stubbornness" of his leader is not so ill-founded after all!

F. C. BLACKMORE.

More Confirmation for "Mixture"

IN his letter under the above head in *Flight*, March 28th, "Mixture" is quite correct in assuming that with identical power settings on two aircraft of the same type, but with different payloads, both will consume the same number of gallons per hour, although the heavier of the two will necessarily have a lower a.m.p.g. value than its fellow.

The case is clarified when it is appreciated that as the power settings are identical, the consumption relative to time must also be identical, quite irrespective of the *aircraft* load. The latter quality has an effect only on the work produced by the power units, that is to say, only on the speed of the machine for a given power output.

Thus it is quite apparent that both aircraft will consume fuel at the same time-rate (gall/hr.) but that, for the same range, the heavier machine will consume more fuel due to its lower a.m.p.g. performance.

C. O. N.

RED TAPE

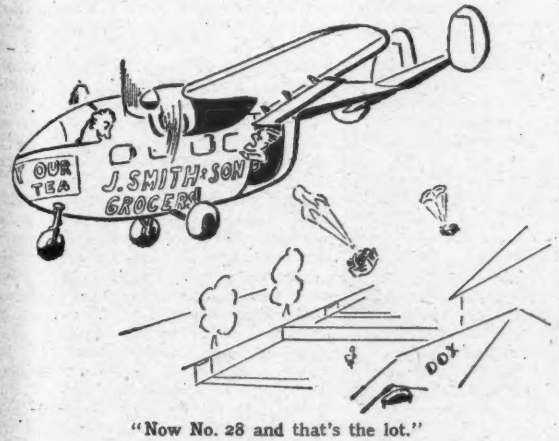
Ex-R.A.F. Pilots and "A" Licences

SOME time ago I put in an application for an "A" licence. I was then sent various forms including one for a medical examination. I replied that I had been an R.A.F. pilot and had been demobilized in January, when I had undergone a very thorough medical examination covering all the points required by the civil aviation authorities. I gave the fullest facts covering time and place of my demobilization so that any details of my medical could be checked with Air Ministry.

I have now been informed that this Service "medical" is not sufficient, so that I must now undergo the entirely unnecessary inconvenience and expense of a civilian examination. Though small in itself, an incident of this nature does not seem to suggest a determination to encourage private flying.

Since there are likely to be many applications from ex-R.A.F. pilots for civilian licences it would be helpful if, in future, the demobilization medical was considered sufficient, provided the application was received within a reasonable period after such an examination.

H. T. F.



"Now No. 28 and that's the lot."

ON BEING C.G.-CONSCIOUS

Automatic Indication

I SHOULD have thought that a quite practicable solution to the determination of c.g. position when loading aircraft could be arrived at by incorporating in the landing gear some form of linear indication. For example, if the static compression of the shock absorbers in the main and nose, or tail, legs are known, then on these data can be based the determination of the aircraft's c.g. for any applied load according to the further proportional compression of the undercarriage legs.

Desynn indicators from each strut would, perhaps, be the most convenient way to transmit readings, and, if each leg were provided with an additional scale showing the obtaining degree of static compression of the strut, the desynn indications read in conjunction with the static compression data would provide a ready determination of c.g. position.

A setting adjustment on the desynn gauges would allow calibration for the static conditions obtaining, and then loading could go ahead, keeping the needles of the desynn gauges within the predetermined limits.

A. M. MONDAY.

"TEE EMM" TRIBUTE

P/O Prune Demobilised

I FEEL sure that I shall be only one of very many demobilised (or serving) R.A.F. types who will miss that excellent little wartime production, *Tee Emm*, which was recently published for the last time. As an official document it was unique for its remarkable combination of hard fact and humour, and both thanks and praise are due to the staff who wrote, illustrated and produced it. Everyone read *Tee Emm* without being told to do so, and personally I would like to thank the Chef for serving up plums and raspberries alike in a hundred-and-one appetising ways.

Tee Emm's hero (?), P/O. Prune has become a national character, and it would be hard to find a better medium for official publicity than small pamphlets styled on *Tee Emm*, and employing its characters and methods—even perhaps to the extent of threatening the award of Highly Derogatory Orders.

I suggest that at any time the Air Ministry wish to put something over to the public in a thoroughly acceptable manner, whether it concerns recruiting, rates of pay, air travel or what-have-you, a quick look at *Tee Emm* might prove very idea-producing.

TWOPENNY.

NOVELS AND NONSENSE

A Case of "Double Dutch" Navigation

IT is a commonplace that when our authors, masters of their craft though they may be, wander into the technicalities of trades of which their knowledge is of the scantiest, they can produce remarkable results.

I recently came across a fine example of this in a novel by a well-known writer, a former winner of the Hawthornden Prize, and one acknowledged by all to be in the first rank of the rising novelists of the day.

One of the characters in this novel sets out on a trip in a Dutch airline aircraft (the airline, fortunately, not being specified) in which, apparently, the passengers were able to observe the activities of the crew. Towards the end of the journey, whilst flying in cloud, "The plane slanted . . . they passed through bumpy air until land appeared. . . . The wireless man paid out a weighted cord (could this be the trailing aerial?) through the floor of the machine, testing the wind currents." The pilot, who apparently had forgotten his maps and was thus unable to get a pin-point, and whose navigator had elected, wisely perhaps, to stay behind for this trip, seemed to be satisfied with the results of this curious operation, for the author goes on to record that "The pilot's bearings taken, they rose again into the waste of cloud."

Notwithstanding this novel method of navigation, their destination was finally reached and, "Nosing down, they swung over a wide arc over sea, over cliff, over sea, the wings were flattened to lose the wind's resistance, they soared up again in a burst of engine, then drove down, touched and sprang from the pale grass, bounced and beat it down."

The passenger, by now no doubt paler and greener than the grass, stepped out to behold "The huge aerodrome . . . with machines parked half-a-dozen deep, the pilots taxi-ing casually here and there, trying to find room, bouncing back and forth, beckoned by one official with his cap askew.' It might well be! The control tower staff had presumably gone home or perhaps had shot themselves in despair.

I have no doubt that the gifted author, should he read this letter, will recognize his words, and I hasten to assure him that I quote these passages in a spirit of helpfulness rather than of criticism.

F. H. POTS, Flt. Lt., R.A.F.V.R.

Aeronautics and the Metallurgist

Value of "Elongation" Examined : Suitability of Beryllium Alloys : Quality and Its Cost

A PAPER of much interest was delivered under above title before the Royal Aeronautical Society on April 25th by Dr. Leslie Aitchison, who is professor of industrial metallurgy at Birmingham University.

Dr. Aitchison opened by saying he would venture to assert that more metallurgical developments of recent years can be traced to the problems posed by aircraft and aero engine designers, and the efforts made by the metallurgist to solve them, than to any other single cause. He suggested, therefore, that his review could best be made by trying to reach an answer to the three questions, "Where have we come from?", "Where are we now?" and "Where are we going?"

With regard to the first question it could be stated that so far as simple strength as displayed by the "maximum stress" is concerned, the materials used in this recent war differ but little from those used in the previous one; and further, that the aeronautical metals employed by all the protagonists, friendly and enemy alike, in the recent war are virtually identical. On viewing the matter on the "strength basis" it seems not far wrong to say that steel with a high level of maximum stress at 100 tons/sq in was as strong in the Kaiser's war as in the last, and that the wrought light alloys at 25 tons/sq in in 1918 were only from 3-7 tons/sq in, depending on the manufactured form, weaker than the materials of 1943.

As to "Where are we now?" the lecturer considered that the investigation of the structure of metals based on crystallography, the electron theory of matter and thermo-dynamics, is yielding generalizations of a most illuminating type that will undoubtedly effect metallurgical development most markedly in the years to come. For the first time the science of metals has become susceptible of mathematical treatment which virtually means that it has passed from the empirical to the exact.

Inter-war Developments

In the ferrous world two not entirely unrelated developments stand out as the fruits of the activities of the isthmus years. The first is the blossoming of stainless steels in their abundance and variety and the second is that of materials to give satisfactory service at high temperatures.

Perhaps the non-ferrous metals have displayed rather more spectacular developments which may partly be related to their vastly increased employment, particularly in airframes.

Precipitation heat treatment has aided wrought aluminium alloys not a little in the general lifting of maximum and proof stresses, whilst alloys that contain a fair content of zinc—5 to 7 per cent—together with copper, magnesium, silicon, and manganese in appropriate proportions, have benefited by increases in strength properties approximating to 35 tons/sq in for proof stress and 40 tons maximum stress.

The other more obvious developments in the non-ferrous sphere are twofold. The first is the application of the process of full heat treatment to certain copper alloys, several groups of alloys having appeared that owe their useful mechanical properties to this form of treatment, perhaps the most remarkable being that of copper with a small percentage of beryllium. These alloys respond to mechanical and thermal treatments very satisfactorily and the resulting strength figures are striking. By heat treating an alloy of copper containing about 2½ per cent of beryllium the combination of 65 tons/sq in proof stress with 85 tons/sq in maximum stress can be secured.

Regarding the question "Where are we going?", in respect of aeronautical metals it is the engineer who states the ends and the metallurgist who must contrive the means—if he can. What then are the ends devised by the engineer?

By
LESLIE AITCHISON,
D.Met. D.Sc., F.R.I.C., F.R.Ae.S.

They may be stated simply to be the possession of the highest possible mechanical properties by metals of the lowest possible density that are at the same time homogeneous and permanent.

These being the ends, what of the means? If the figures for the strongest specifiable alloys are compared with the strength of the parent metal it emerges that the structually usable steels have a strength about five times that of iron, the corresponding aluminium alloys a strength from nine to ten times that of the unalloyed metal, the stronger copper alloys a strength of about six times that of copper, whilst in magnesium the increase has been approximately three times.

So far as is known there is no law that lays down the greatest possible magnification in strength of a metallic element, but a broad view of the historical facts of alloy development seems to suggest that in the case of iron, aluminium and copper, at any rate, the limit of strengthening through the conventional and employed processes of alloying and heat treatment has been approached. This view is based on the strength values actually used, but is not even approximately true if strength and strength alone be the sole criterion.

The lecturer then asked, "Is the insistence on 'elongation' the worship of a fetish, or a fear of a bogey?" Insistence on a high ductility value in materials undoubtedly acts as a bar to the realization of higher strength values, and it seems worth while to come to grips with the problem and to separate the ductility utilized during fabrication from that required by the metal in order that it shall function satisfactorily in service.

The matter of ductility may also have a profound effect on the practical possibilities of raising the value of the elastic moduli in materials of construction. The increased knowledge of the metal state and the physical theories have shown that there is a possibility of bringing about useful changes in the values for the moduli. Doubtless the aeronautical engineer would benefit enormously if materials having the same order of strength and density as those at present in use but possessing higher values of elastic moduli were available.

To make a bold statement that the limits of strength have been reached with the principal basic metals would be foolish, but it seems likely that it has been approached. It is also true that virtually all metals present in large quantities (from the metallurgical standpoint) in the earth's crust have by now been brought under examination and submitted to the traditional processes.

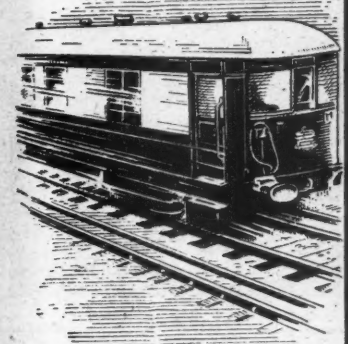
There is one metal that seems worthy of rather more attention than it has so far received because it possesses certain properties that would endear it to the aeronautical engineer if some of its other properties could be smoothed out. Beryllium has two useful properties at least, a low density (1.84) and a high value of Young's Modulus (42,000,000 lb/sq in). In other words its density is as low as that of magnesium while its value of Young's Modulus is considerably higher than that of steel.

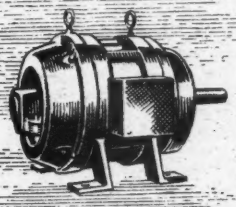
Aeronautically Attractive Metal

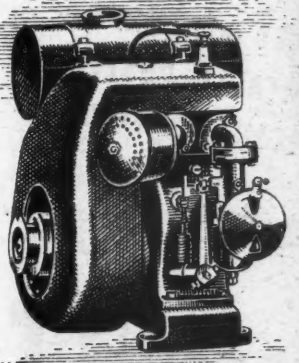
A metal with this combination of properties is bound to be attractive to the aeronautical engineer if it can be made available. Beryllium is not very scarce; it is stated to be about as plentiful as tin. So far it appears to be a very brittle material, but whether it is essentially so or whether the almost complete lack of ductility is the result of incomplete purity or contamination during the manufacturing methods employed has not yet been resolved. But alloys of beryllium with aluminium appear to possess a fair measure of ductility as well as some other useful properties, and, to say the least, this metal and alloys containing considerable proportions of it are worthy of intense investigation in the light of the very high values of modulus of elasticity thus obtainable.

During the inter-war years the revolution in metallurgical thought and in the theory of the metal state, which dates from the advent of X-ray crystallography, eventually based on the electronic theory of matter has intensified metallurgical research in the physical and physico-chemical fields, and sharpened our appreciation of the behaviour of metals under a considerable variety of conditions.

It is well known, for instance, that the developed strength of the metals we







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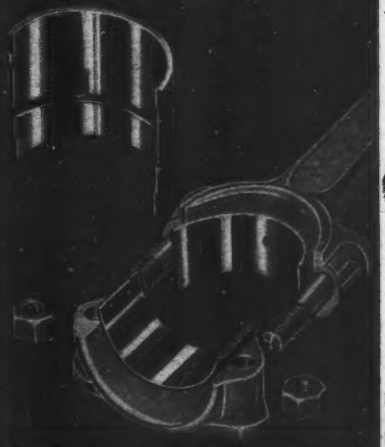

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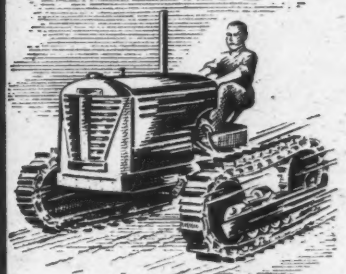

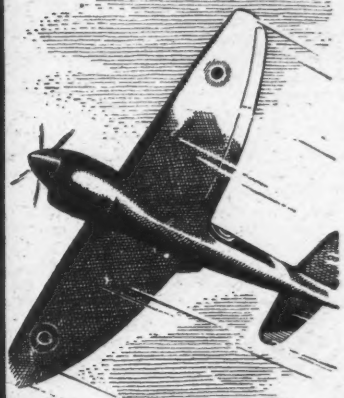

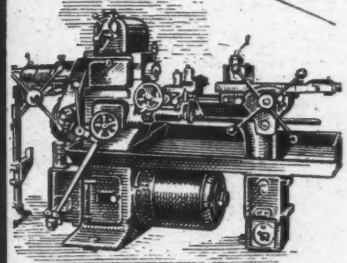

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use are far below those they may be expected to possess on the basis of their atomic structure. There is no likelihood of this difference being bridged—even in part—unless the reason for the difference is understood and explained.

It has been revealed by crystallographers that the arrangement of the metallic atoms within their particular crystalline lattice means that in most metals the elastic moduli differ according to the direction in which the stress is applied relative to the axes of the crystal. This directionability of properties (which is not confined to the elastic moduli) has been used already in certain forms of engineering and might possibly repay investigation in the direction of producing directionalized alloys for use in aircraft.

Statistical examination of test records during the war has shown that quite a high percentage of the material thrown up by the ordinary process of production has properties markedly above the specification figures. Such material can be extracted, and if it is true that a pound saved in the weight of an aircraft structure is worth a pound of gold such material can be paid for. The normal evolution of manufacturing competition will do the rest.

Summing up, Dr. Aitchison suggested that pure research, technological development, and productive science must go hand in hand and none of the three can be neglected in favour of the other. Pioneering is justifiable to-day as much as ever it was though it probably costs more, and the aeronautical engineer must again call on the full energies of the metallurgist both in the laboratory and in the factory, but at the same time the engineer must support the metallurgists' efforts.

AERONAUTICS AND THE METALLURGIST

THE INDUSTRY

NEW BRANCH

THE Hoffmann Manufacturing Co., Ltd., Chelmsford, Essex, informs us that it is opening an additional branch office at No. 5, Municipal Buildings, Charles Street, Leicester (Telephone 5181). A stock of bearings will be carried and the depot will be under the charge of one of the firm's skilled technical engineers.

CONCENTRATION

FROM dispersal through war conditions, Brown Brothers (Aircraft), Ltd., have moved their works and offices to Houghton Road, Northampton (telephone: Northampton 4940), where they are concentrated in modern works and administrative buildings.

The registered offices of the company are still at 26, Great Eastern Street, London, E.C.2.

NIGHT LIGHTS BY DAY

THE scheme for Day-Night flying described in our issue of March 28th was worked out by R.A.F. technicians and engineers from Philips, who were the pioneers of sodium lighting. Its characteristic golden-yellow light is now familiar to most people, since it is to be seen on hundreds of miles of roads all over the country.

For the Day-Night flying training scheme, Philips designed many special pieces of apparatus and supplied many thousands of sodium lamps at short notice.

AIR COURIERS

THE Bristol Aeroplane Company, Ltd., announces that Mr. F. W. Griffith has resigned from the Flight Test Department in order to resume his pre-war air charter business with Air Couriers, Ltd.

In the early part of the war Mr. Griffith was with British H.Q. in France as civilian personal pilot to the Air Officer Commanding, R.A.F. Component, B.E.F., and as a test pilot he flew every type of Bristol military aircraft produced by the company during the war.

Air Couriers, Ltd., 149, Waverley Road, Stoneleigh, Ewell, Surrey, hope to resume operations from Heston.

M.B.V. PROCESS

THE BRITISH ALUMINIUM CO., LTD., have issued a data leaflet concerning the M.B.V. process for protecting aluminium from the effects of corrosion. The process is a chemical method whereby the natural film of oxide on the surface of the aluminium may be increased to provide improved resistance to attack.

Copies of the leaflet may be had from the company at Salisbury House, London Wall, London, E.C.2.

SALES APPOINTMENT

ON his release from military duties, Mr. R. R. Jordan has joined the board of directors of the Carrick Engineering Co., Ltd., Stewarton, Ayrshire, manufacturers of precision ball and roller bearings. Mr. Jordan is taking charge of the company's complete sales organization, both at home and abroad.

To meet the heavy demand for their products, the company is embarking on a considerable expansion scheme to their premises at Stewarton.

IN THE MIDLANDS

MR. W. S. WALTER, who represented Ransome & Marles, Ltd., in the East Midland area for 25 years, died during the war period, and the company record their appreciation of his long service.

Mr. W. H. Royall, who has been with this company for 20 years (the major portion of which has been spent in the technical drawing office and on the sales side), has assumed office as East Midland area manager, and new offices in Leicester were opened on April 22nd. Mr. Royall will be assisted on the sales side by Mr. J. R. H. Barefoot, and the office and stock room arrangements will be the responsibility of Mr. W. S. Welby.

ALUMINIUM ALLOYS

THE British Aluminium Company has acquired the Latchford Locks (Warrington) refinery and powder works, and now produces a full range of secondary aluminium alloys for incorporation in wrought materials and for casting and other purposes. The company has for a great many years been one of the leading manufacturers of granulated aluminium powder in all grades.

BRISTOL EXHIBITION

THE English Electric Company's Activities Exhibition will be opened at St. John's Parish Hall, Whiteladies Road, Bristol, 8, by the Lord Mayor of Bristol, Alderman James Owen, J.P., tomorrow, May 3rd, 1946, at 3 p.m., and the public are invited to inspect the exhibition which will be open from May 6th until May 11th.

It shows, in miniature, how the company's four works, at Stafford, Rugby, Bradford and Preston, met the country's needs in wartime, and how they have now resumed the manufacture of the essential electrical machinery which is in such great demand both at home and abroad.

The basic method adopted in the "War Story" section of the exhibition is to show the progress of the war in a series of illuminated panels, while at each stage the company's contribution is demonstrated by photographs and models.

"PROGRESS"

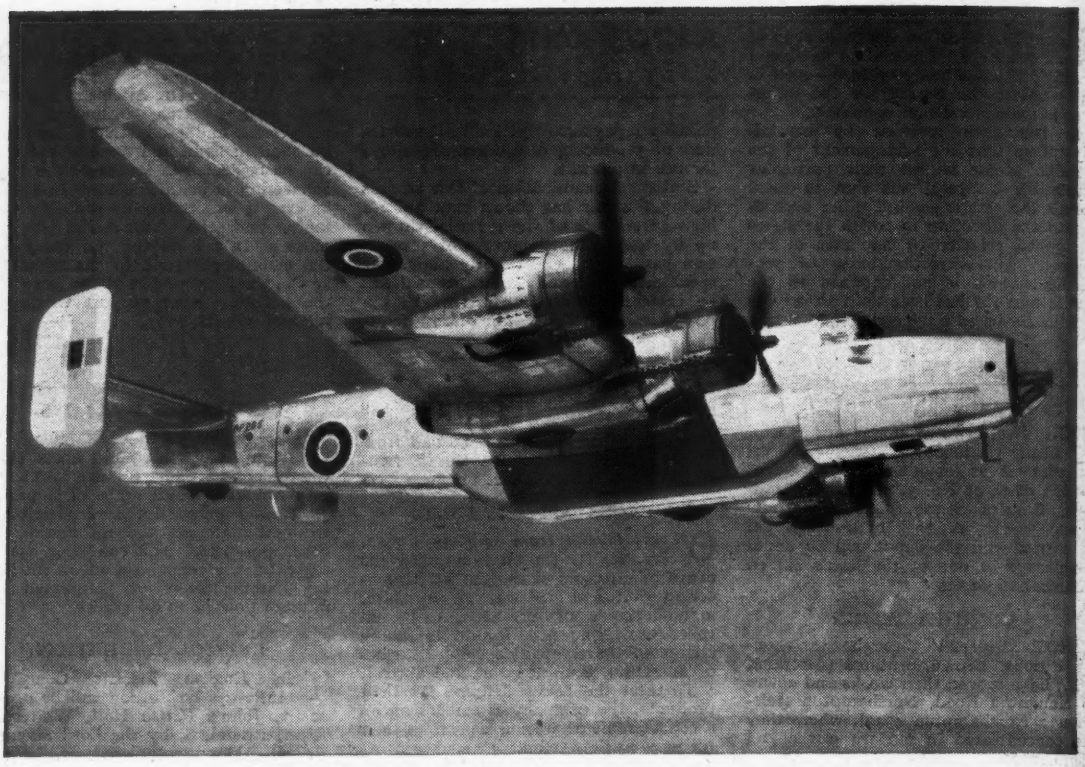
THE title of "Progress" given to the film depicting the origin and development of the Rootes Group might just as deservedly be bestowed on the work of its director, Cecil Musk, who has made this Edward W. Beckett production for the Film Producers Guild, when one thinks back to the industrial film of a few years ago—say just before the outbreak of war.

With very few exceptions, the main problem facing the producers of a film of this kind (which one may perhaps describe as a commercial documentary) must surely be to make it appeal, *as a film*, to people who have little or no personal interest in the organization itself. Mr. Musk, whose work as a director we have seen and admired before, manages to achieve this.

"Progress" starts off on the right foot by the simple expedient of using the never-failing "human angle" approach—to put it bluntly, we see Mr. Barry Morse get off with Miss Edana Romney in Green Park and in no time at all he is telling her all about Devonshire House on the opposite side of Piccadilly, and how it all started in a little wayside garage down in Kent. Well, you may not hold any shares in Rootes, but you can't help being interested in this story of a business romance, and having thus got over your natural "sales resistance," Mr. Musk can almost afford to leave the rest to his cameraman, because in this particular case the story itself was really worth telling.

The film is a smooth job right through its 30 minutes run—so smooth in fact that one quite forgot the exciting film of the Grand National which preceded it. If there is any criticism worth making, it is that the incidental music might have been more incidental. Perhaps it was the small (but very comfortable) British Council cinema theatre in Hanover Street, but the volume of the orchestral accompaniment seemed "a bit much."

N. D. R.



DEMOBILIZED: After a fine wartime record as a bomber, the Halifax is now proving a useful interim transport. The civil version, known as the Halton, is shortly going into service with B.O.A.C.

SERVICE AVIATION

Royal Air Force and Naval Air Arm News and Announcements

Pacific Fleet Appointment

THE KING has been pleased to approve the following appointment: Vice-Admiral Sir Denis W. Boyd, K.C.B., C.B.E., D.S.C., to be Commander-in-Chief British Pacific Fleet, in succession to Admiral Sir Bruce A. Fraser, G.C.B., K.B.E., to date early June, 1946.

Singapore Service

ON April 22nd a York of Transport Command inaugurated a daily service to Singapore, flying from Lyneham, Wiltshire, providing speedier carriage of Service mail and passengers to the Far East. The new service, which is the longest yet scheduled, is expected to take three days and four hours for the journey.

Flight times are: Cairo 14¾ hours, Karachi 30 hours, Calcutta 51 hours, and Rangoon 69 hours, including halts for refuelling and changing crews. The Singapore route has been made possible by extensions to Changi airfield at Singapore.

Awards

Royal Air Force

THE KING has been graciously pleased to approve the following awards:—

George Cross.

Flt. Lt. Hector Bertram GRAY, A.F.M., Royal Air Force (deceased).

Whilst a prisoner of war in Japanese hands, Flt. Lt. Gray was one of a small group of officers and men engaged in organizing a general escape. The Japanese discovered the plan, and on July 1st, 1943, Flt. Lt. Gray and two non-commissioned officers were arrested. Two Army officers were arrested later.

He was interrogated on several occasions, starved, tortured and finally brought before a Japanese Court Martial where he was sentenced to death. He was subsequently shot.

As the first officer to be arrested, Flt. Lt. Gray bore the brunt of the torture inflicted by the Japanese. In spite of this, and the fact that he was suffering from illness when arrested and never recovered his health during the five months of his imprisonment, he steadfastly refused to implicate any others.

His magnificent fortitude and courageous spirit in the face of torture remained unbroken to the last.

Flt. Lt. Gray was born in 1911 at Gillingham, Kent. He enlisted in the R.A.F. as an apprentice at Cranwell in January, 1927, became a sergeant pilot in 1936, and was commissioned in April, 1940. He was awarded the A.F.M. in 1939.

Badge of No. 233 G.R. Squadron, R.A.F.—"Fortis et Fidelis" (Strong and Faithful).

Badge of No. 608 North Riding (F) Squadron, A.A.F.—"Omnibus Ungulis" (With All Talons).

O.B.E. (Mil.)

Flt. Lt. E. S. A. SANDERS, R.A.F.V.R., No. 139 (Jamaica) Sqn.

M.B.E. (Mil.)

Flt. Lt. G. H. LONNBERG, R.A.F.V.R., No. 15 O.T.U.
Flt. Lt. B. BROWN, R.A.F.V.R.
Lt. F. C. LORENTZ, S.A.A.F., No. 4 Sqn.
W/O E. G. S. MONK, R.A.F., No. 21 (P) A.F.U.
W/O. D. J. CRIMP, R.A.F., No. 1 Glider Training School, No. 23 Group.
W/O. D. B. THROWER, R.A.F.V.R., No. 405 Sqn.

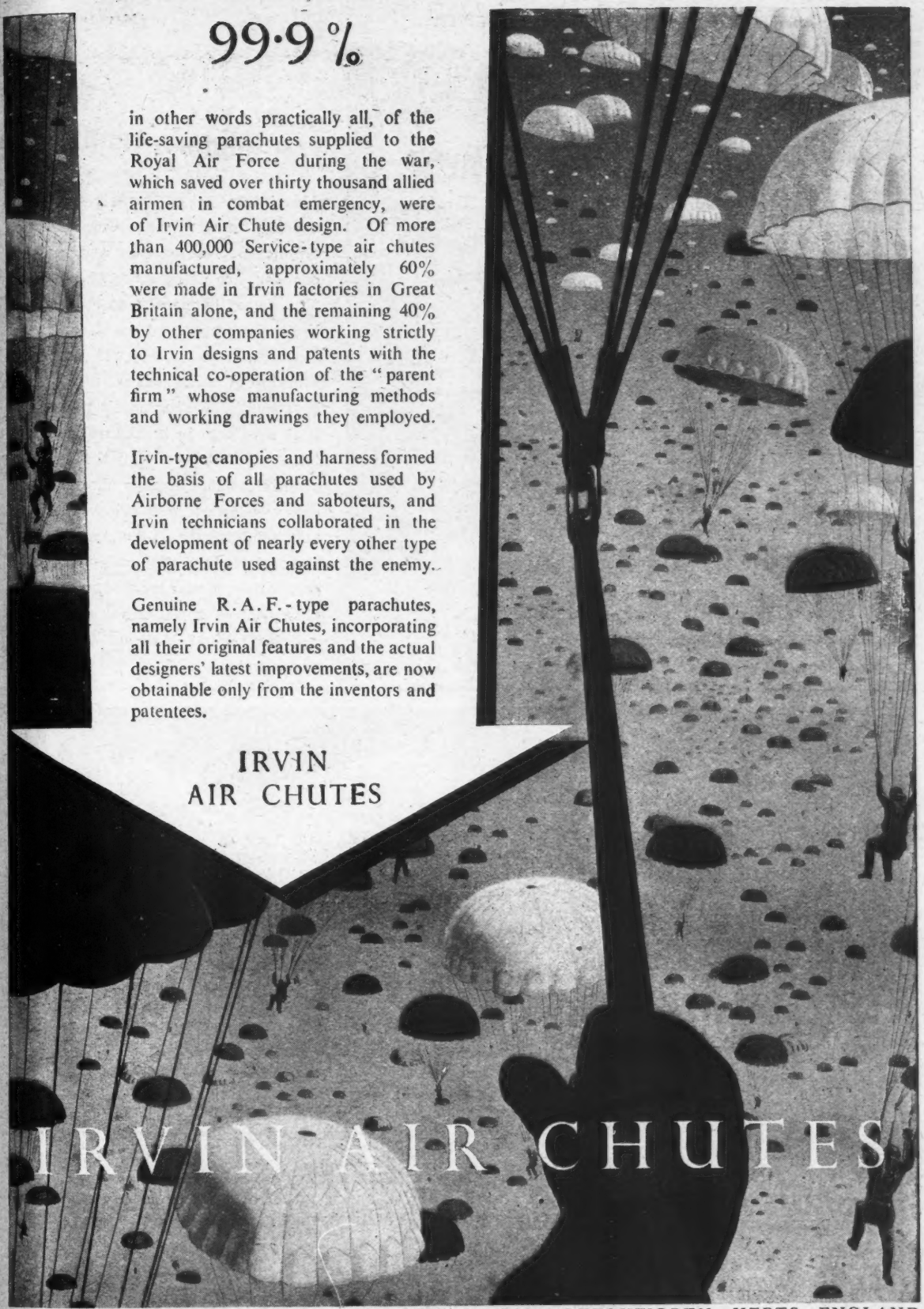
99·9 %

in other words practically all, of the life-saving parachutes supplied to the Royal Air Force during the war, which saved over thirty thousand allied airmen in combat emergency, were of Irvin Air Chute design. Of more than 400,000 Service-type air chutes manufactured, approximately 60% were made in Irvin factories in Great Britain alone, and the remaining 40% by other companies working strictly to Irvin designs and patents with the technical co-operation of the "parent firm" whose manufacturing methods and working drawings they employed.

Irvin-type canopies and harness formed the basis of all parachutes used by Airborne Forces and saboteurs, and Irvin technicians collaborated in the development of nearly every other type of parachute used against the enemy.

Genuine R.A.F.-type parachutes, namely Irvin Air Chutes, incorporating all their original features and the actual designers' latest improvements, are now obtainable only from the inventors and patentees.

IRVIN
AIR CHUTES



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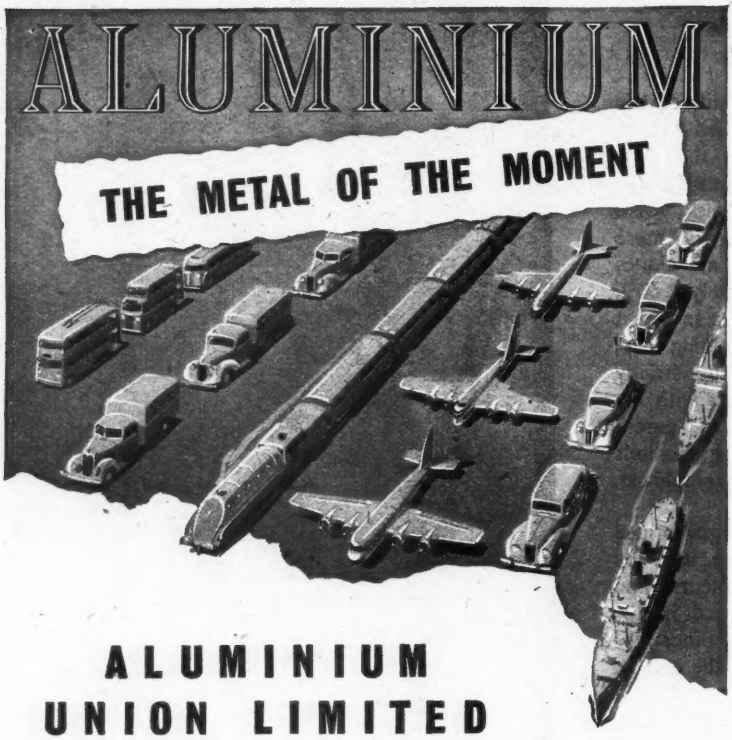
Telegraphic Address: IRVIN, LETCHWORTH



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Consultants on: Aircraft Instruments, Electrical Equipment, Testing Equipment, Test House planning, servicing and maintenance.

Facilities: Include Design and Drawing Offices staffed by keen and qualified Technicians, Machine Shop, Assembly Shop, Dial Luminising Department.

Note: The Company operates agencies at home and abroad and is prepared to enter any new field within its Memorandum and Articles of Association.

SERVICE AVIATION

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations.

Distinguished Flying Medal

Flt. Sgt. I. T. BROOK, R.A.F.V.R., No. 215 Sqn.
Flt. Sgt. W. F. HILL, R.A.F.V.R., No. 215 Sqn.

Royal New Zealand Air Force

THE King has been graciously pleased, on the advice of His Majesty's New Zealand Ministers, to give orders for the following awards in recognition of conspicuous service in operations against the Japanese:—

C.B.E. (Mil.)

Act. Air Cde. G. N. ROBERTS, A.F.C., R.N.Z.A.F.

O.B.E. (Mil.)

Wing Cdr. G. CARTER, R.N.Z.A.F.
Sqn. Ldr. R. J. LEONARD, R.N.Z.A.F.
Sqn. Ldr. H. H. SMITH, R.N.Z.A.F.

M.B.E. (Mil.)

Act. Sqn. Ldr. C. C. N. JOHNSTON, R.N.Z.A.F.
The Rev. W. W. AINSWORTH, R.N.Z.A.F.
The Rev. T. WILLIAMS, R.N.Z.A.F.

Roll of Honour

Casualty Communiqué No. 575.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 242 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. P. Weir.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTON, NOW PRESUMED KILLED IN ACTION.—P/O. G. E. Batchelor; Act. Sqn. Ldr. J. Berry, D.F.C.; W/O. J. G. Galley, D.F.M.; Sgt. R. Hartop; F/O. F. A. Mason; P/O. H. R. Morris; W/O. R. E. Ralph; Flt. Lt. G. Trail; Sgt. R. H. Twin.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. C. Alderson; Sgt. P. A. Alger; W/O. E. R. Andrews; Sgt. J. Ashton; Sgt. R. P. Barton; Flt. Lt. A. O. Black; Flt. Sgt. D. S. Black; Act. Flt. Lt. T. W. Black, D.F.C.; P/O. H. W. Blacklock; Sgt. P. Blake; Flt. Sgt. G. Boag, D.F.M.; F/O. F. J. Booth; Sgt. W. W. Bowden; F/O. A. G. Brandon; Flt. Lt. G. E. Bray; Flt. Lt. J. E. Brook; Sgt. T. Brown; Sgt. G. F. Burgess; Sgt. R. E. T. Burns; F/O. F. Cameron; Sgt. J. E. Cartwright; Sgt. G. Clark; Sgt. O. F. Cleminson; Sgt. R. D. Cole; F/O. C. T. Collyer; Sgt. B. J. Cooper; Sgt. H. G. Copper; Sgt. J. Cottam; Flt. Sgt. R. Cowan; Flt. Sgt. B. Coward; Sgt. S. A. Cracknell; Flt. Sgt. P. G. Cullen; F/O. H. S. Davis; Sgt. A. W. Denby; Sgt. H. T. Dickson; Sgt. J. M. Evans; F/O. W. D. Fairney; Sgt. T. E. Fardoe; Sgt. J. R. Fawcett; Flt. Sgt. T. E. Feaver; Flt. Sgt. J. A. Fell; Sgt. L. Finch; Flt. Sgt. F. A. Fox; Sgt. R. F. J. Franklin; Flt. Lt. G. V. Fulford; Sgt. F. H. Garnett; P/O. T. H. Gibson; Sgt. G. R. Gilfillan; Sgt. G. Gittins; F/O. P. Glenville; Flt. Sgt. D. H. Grant; Flt. Sgt. O. R. J. Green; Sgt. W. H. Grice; Flt. Sgt. G. S. Grogan; Sgt. L. Hales; Flt. Sgt. R. A. Hall; Flt. Sgt. L. S. Harper; Sgt. F. Harrison; P/O. E. A. Hartley; Flt. Sgt. L. H. Harwood; P/O. H. A. Heap; Sgt. H. Hemingway; F/O. J. S. Henderson; Flt. Sgt. N. Heslop; F/O. R. J. C. Higgins; Act. Sqn. Ldr. R. M. Higgs, D.F.C.; Sgt. J. Hoarty; Flt. Sgt. J. H. Holt; Sgt. J. Howarth; Sgt. D. M. Hughes; Flt. Sgt. W. R. S. Hurpell; Flt. Sgt. J. Hyams; Flt. Sgt. A. L. James; Sgt. W. J. James; Sgt. M. Jones; Sgt. W. F. W. Jones; Sgt. K. G. Kemp; F/O. A. J. Kendall; Flt. Sgt. G. B. Kirby; Sgt. H. W. Kirsh; W/O. R. T. Knight; Flt. Lt. J. A. Lamberton; Sgt. J. E. H. Lander; Flt. Sgt. J. Lee; Sgt. L. Letten; Sgt. B. E. Lever; Sgt. T. P. Lonsdale; F/O. C. H. Luxon; Sgt. J. McCabe; Flt. Sgt. E. P. McDonald; Sgt. A. J. McNamara; Flt. Lt. R. D. W. MacKenzie; Flt. Sgt. J. Maltby; Flt. Sgt. P. T. R. Maravan-Williams; Flt. Sgt. L. Marsh; Flt. Sgt. A. Marston; P/O. B. Martin; Sgt. J. G. L. Martin, D.F.M.; F/O. A. Mason; P/O. T. D. L. Mason; F/O. J. R. M. Mills; Sgt. E. D. Mobberley; Sgt. L. Moore; Sgt. B. R. Morgan; F/O. P. Mosby; Act. Sqn. Ldr. S. R. Muller-Rowland, D.F.C.; Sgt. N. F. Nash; F/O. R. A. Nicholls; Sgt. C. A. Nixon; Flt. Lt. J. C. Nixon; Sgt. J. K. Norgate; Flt. Sgt. R. E. North; Flt. Sgt. P. A. J. Offord; Sgt. B. Parker; P/O. A. W. Paul; W/O. T. Peabock; F/O. H. E. J. Perry; P/O. T. J. Perry; Sgt. A. H. Pettman; Sgt. H. S. Picton; Sgt. W. Pollitt; F/O. R. Poole; Flt. Sgt. G. A. Pope; Sgt. A. R. Pritchard; P/O. P. J. Purcell; P/O. K. F. Rawlinson; Sgt. F. Reed; W/O. L. G. Remblance; Sgt. T. Roberts; Sgt. J. A. Robinson; P/O. J. A. Rogers; Flt. Lt. E. S. W. Ross; Sgt. F. A. Rushworth; Sgt. J. G. Sherburn; Sgt. W. Skea; Sgt. J. A. Slater; F/O. P. E. Spink, D.F.C.; Flt. Sgt. W. G. Spratt; Flt. Sgt. E. P. A. Standfield; Flt. Sgt. E. V. Staples; P/O. E. G. Stevens; Flt. Lt. D. Stewart; Flt. Lt. J. G. Strauss; Sgt. W. H. Swan; F/O. C. J. Swann; Flt. Lt. T. J. Tate; Sgt. G. Turner; Sgt. J. J. Turner; Sgt. J. P. Van der Linde; Sqn. Ldr. K. G. J. Wakefield; Flt. Lt. A. W. Walker; Sgt. D. A. R. Walker; Sgt. R. B. Walker; Flt. Sgt. L. B. Waller; Sgt. G. C. Wardle; Act. F/O. R. J. Waugh; Flt. Sgt. A. E. Whitams; Flt. Sgt. J. R. Whitmore; F/O. V. G. Williams, D.F.C.; Sgt. D. Williamson; W/O. A. Wright.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—Flt. Lt. D. MacK. Leitch.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. E. R. Atkinson; Sgt. D. W. H. Davey; Sgt. A. E. Hall; P/O. J. D. Harper; F/O. J. Leadbeater; Flt Lt. D. H. Sumsion; Flt. Sgt. C. F. Wellstead.

MISSING.—Flt. Sgt. D. Bateman; A/C.2 J. Brown; Flt. Sgt. D. E. Butler; W/O. G. E. Chaney; Flt. Lt. J. F. Cuthbert, D.F.C.; Flt. Sgt. B. Ellis; Flt. Sgt. K. H. Goad; F/O. T. W. Humphreys; F/O. J. D. Lorimer; F/O. J. MacP. Ross; Act. Wing Cdr. A. J. Samson, D.F.C.; F/O. E. M. Sissons; F/O. R. H. T. Squire; Flt. Sgt. P. T. M. Stevens; Flt. Sgt. E. W. Trail; Flt. Sgt. F. B. Wilkinson.

KILLED ON ACTIVE SERVICE.—Cpl. H. B. Archer; L.A/C. R. Bell; A/C.1 H. M. Bird; Flt. Lt. G. J. Boniface; L.A/C. D. Briddock; L.A/C. W. J. Chamberlain; Cpl. G. E. Coldwell; F/O. R. D. Cole; Flt. Sgt. E. F. Dean; F/O. J. E. Dickinson, A.F.C.; L.A/C. R. F. Elliott; Act. Flt. Lt. J. R. Foster; F/O. L. M. Francom; Act. Flt. Lt. R. T. Gibson; A/C.2 J. Gray; Sqn. Ldr. R. R. Gregory; L.A/C. V. R. Haddock; L.A/C. A. E. Hamshere; L.A/C. G. B. Jones; Flt. Sgt. G. B. Machin; A/C.1 R. Meadows; L.A/C. J. I. Morgan; L.A/C. R. Richards; L.A/C. E. S. Sutton; Act. Sqn. Ldr. J. C. S. Turner; F/O. A. E. Venables; F/O. G. W. Venables; Flt. Lt. J. Wheeler; F/O. H. O. Young.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. Grunhut; Sgt. S. Reisz.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. H. G. Cawfield; Sgt. A. D. Gash; Sgt. W. G. Impey; Sgt. S. A. Parsons; Sgt. J. Scott.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. R. Bradford; Flt. Lt. P. C. Dravers; Sgt. W. B. Gillingham; F/O. J. C. Goodacre; F/O. R. Jarrett; Sgt. K. J. Mizon; Flt. Lt. C. P. O'Connor; Sgt. F. H. Truffett; F/O. N. Wilkinson; Sgt. R. Williams.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 A. J. Allard; Flt. Sgt. R. R. J. Ellis; Flt. Lt. E. I. Jones; Flt. Sgt. J. Prince.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. H. J. M. Harris.

DIED ON ACTIVE SERVICE.—L.A/C. W. Aspinall; L.A/C. C. W. Betts; L.A/C. R. J. Brand; W/O. C. W. Brazier; L.A/C. F. Buckley; P/O. H. J. Carley; Cpl. W. J. Corbett; L.A/C. L. Coyne; L.A/C. H. G. T. Cummins; W/O. H. Eldred; Cpl. W. Evans; L.A/C. K. A. R. Giles; L.A/C. T. Holden; F/O. G. F. McAinsh; A/C.2 J. R. Mawdsley; L.A/C. A. A. Millo; Act. Cpl. J. T. Minney; W/O. C. Nicholson; Sgt. H. O'Dell; W/O. J. Ogston; Cpl. R. E. Oliver; Cpl. G. E. Oughton; L.A/C. A. W. Pollard; Wing Cdr. H. R. Powell; Cpl. H. M. Redman; F/O. A. G. Richardson; A/C.1 E. Richardson; Sgt. J. C. Scott-Needham; A/C.1 G. H. Service; Flt. Lt. D. V. Smith, D.F.C.; L.A/C. E. Smyth; A/C.1 P. M. B. Stockman; L.A/C. J. Taylor; Sgt. D. A. Tebbutt; L.A/C. G. Thornton; L.A/C. F. Voce; Cpl. R. T. Wagland; Flt. Sgt. W. E. Weightman; Cpl. R. C. H. Young.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. I. M. Doig; L.A/CW. H. M. French; Cpl. M. N. J. Grose; L.A/CW. D. W. Hubble; L.A/CW. A. McD. F. Young.

R.A.F. WAR COMMANDERS

Air Marshal Sir James Robb

AIR MARSHAL SIR JAMES MILNE ROBB, K.B.E., C.B., D.S.O., D.F.C., A.F.C., has held a variety of appointments during his Service career, but he has never been away for long from posts which have carried direct responsibility for active flying or air operations. Fighter Command, of which Sir James has now been Air Officer Commanding-in-Chief for some eleven months, is fortunate in having such an experienced Commander with so fine a record.

He first joined the Services in September, 1914, as a private in the 4th Northumberland Fusiliers, and was commissioned shortly afterwards. Transferring to the R.F.C. in 1916, he served during the remainder of that war with Nos. 40, 32 and 92 Squadrons, and was awarded a D.F.C. for leadership of air patrols and for the destruction of seven enemy aircraft. After serving with the Army of the Rhine, he went to Iraq in 1922, and while C.O. of No. 30 Squadron in 1925 received the D.S.O. for operations in Kurdistan. When he returned to this country, Robb became Chief Flying Instructor at the Central Flying School.

During 1932 he completed a course at the Royal Naval Staff College, and afterwards was posted, first as Senior Air Force Officer to H.M.S. *Eagle*, and two years later as Fleet Aviation Officer to the C.-in-C. Mediterranean Fleet. From the latter appointment he returned to the C.F.S. at the end of 1936 to command the School.

Soon after the outbreak of war in 1939, Sir James was promoted to the rank of Air Commodore and, in March, 1940, went to Canada with Lord Riverdale's Mission. Upon his return, he was appointed A.O.C. No. 2 Bomber Group and, about a year later, A.O.C. No. 15 Fighter Group, receiving promotion to Air Vice-Marshal, and remaining in this appointment until 1942, when he joined the Chief of Air Staff's department at Air Ministry for special duties and liaison work. In 1943 he was appointed Deputy A.O.C. to H.Q., North-West Africa Air Command, and with the re-formation of the forces in this theatre, became Chief of Staff to H.Q., Mediterranean Allied Air Force.

When, in 1944, the Allied Expeditionary Force was formed, Sir James joined its Supreme H.Q. as Deputy Chief of Staff (Air). In November of that year he was promoted Air Marshal, and received a knighthood in the New Year's Honours List for 1945. Thus he played a leading role in the success of our combined air operations, receiving in recognition from the President of the U.S.A. the Legion of Merit in 1943 and the D.S.M. last year. Sir James is 51, and was educated at Geo. Watson's College, Edinburgh, and Durham University.

SERVICE AVIATION

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—W/O. F. N. Leamon.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. N. J. Costin; P/O. L. D. Heath; Flt. Sgt. W. W. Hiscock; P/O. C. C. Hunt; Flt. Sgt. C. W. Lawton; F/O. T. R. Millar; Act. F/O. R. E. Pellew; P/O. H. F. Roome; P/O. N. G. Steer; P/O. E. R. Tibbits; Flt. Sgt. C. A. Vieritz; F/O. J. K. Wood.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. A. Farmer.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. D. H. R. Evans.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. P. H. Kearse; Flt. Lt. J. A. Malloy; F/O. H. F. Wakeman; F/O. I. J. V. Wallace.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. A. J. Anderson; Flt. Lt. E. R. Church; Flt. Lt. R. Clasper; Flt. Sgt. B. V. Cobbett; Flt. Sgt. D. J. Heath; P/O. N. Holyk; F/O. F. W. How; P/O. C. D. B. Hubley; P/O. F. Kohut; W/O. A. A. McCaig; P/O. J. A. S. MacGregor; Flt. Sgt. J. B. McGregor; F/O. C. A. Moss; F/O. R. K. Nickle; F/O. J. A. Noble; F/O. S. J. Queen; F/O. D. B. Robertson; Flt. Sgt. D. O. Schneider; Flt. Sgt. G. E. Smith; W/O. J. H. Soper; P/O. N. R. Springstein; P/O. V. Stear; P/O. C. R. Tait; P/O. W. H. Tomlinson; Flt. Lt. E. H. Treleaven; F/O. J. G. Wills.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. M. J. Miln.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. W. Boocock.

KILLED ON ACTIVE SERVICE.—P/O. W. J. H. Henley.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. J. E. Andrews.

KILLED ON ACTIVE SERVICE.—Capt. E. R. Larter, D.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Capt. R. C. Thompson.

Casualty Communiqué No. 576

Of the names in this list, 243 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—W/O. R. W. Evered; F/O. C. N. Farnes; Flt. Sgt. A. C. Hitchin; F/O. J. Johnstone; W/O. E. G. P. Leaver; Sgt. J. B. Shakespeare; Sgt. D. P. Swain.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. R. M. Aldus; Group Capt. C. H. Appleton, D.S.O., C.B.E., D.F.C.; Sgt. R. L. Armstrong; F/O. R. Bamberough; Flt. Sgt. D. M. Barr; Flt. Sgt. G. W. Bell; Sgt. V. S. J. Belt; F/O. R. E. Blake; F/O. K. H. Bonner; F/O. S. Chappell; Flt. Lt. T. N. Cooper; Sgt. W. D. Crail; Sgt. J. MacG. Croll; Sgt. E. Crooks; P/O. J. Daly; Flt. Sgt. G. W. Dawson; Sgt. J. M. Dobson; Sgt. W. A. Drew; Sgt. F. Edwards; F/O. M. Enright; Sgt. B. Fanthorpe; Sgt. R. C. Fitzgerald; Sgt. G. J. Fretter; Flt. Sgt. D. Gardner; P/O. D. Hardie; Sgt. R. G. Hargreaves; Flt. Sgt. J. F. P. Harper; Flt. Sgt. H. R. Harris; Act. F/O. K. Harrop; Flt. Sgt. S. N. Hilder; Sgt. S. Hodgkinson; F/O. N. H. Hornby; F/O. G. E. Hudspith; Flt. Sgt. L. Jackson, D.F.M.; Sgt. H. Jeffries; Sgt. E. P. Keene; F/O. J. C. King; F/O. D. B. Lambton; Sgt. J. S. McClenahan; Sgt. W. M. McIntyre; Sgt. J. G. McKenzie; Sgt. J. F. Mason; Flt. Lt. T. S. F. Meadows; Sgt. G. J. B. Miller; F/O. J. E. Morris; Sgt. T. Morris; Sgt. E. L. Morter; F/O. R. A. Naiff; Act. F/O. C. D. Neale; Sgt. K. W. Nettleton; Sgt. G. P. Neville; P/O. J. L. Nicholson; Sgt. D. Noble; F/O. M. A. Oakley; Sgt. L. R. R. A. Parker; Sgt. R. J. Patrick; F/O. A. J. Quin; Flt. Sgt. T. Rees; W/O. W. S. Robson; Sgt. W. A. Rogers; P/O. D. A. R. Rutland; P/O. R. W. Sandover; W/O. R. A. Scott; Sgt. V. Sheppard; Sgt. J. R. Smillie; Sgt. D. C. Spiden; P/O. W. Stones; F/O. J. Thomson; Sgt. W. C. Thorogood; F/O. P. J. Tofield; Sgt. L. T. Webster; Sgt. R. J. West; Sgt. L. Whalley; Sgt. R. White; Sgt. R. G. Williams; Sgt. R. F. Winstanley; P/O. F. Wood.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. V. H. Binch; Sgt. E. W. McGrath; F/O. D. F. Richer.

MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. J. Beadle; F/O. R. Catterall, D.F.C.; F/O. F. D. Devlin; Flt. Sgt. D. J. Ferris; Flt. Lt. M. N. Mathias.

WOUNDED OR INJURED IN ACTION.—W/O. R. W. MacDonald.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. S. R. Holland.

PREVIOUSLY REPORTED MISSING, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. T. C. Jones.

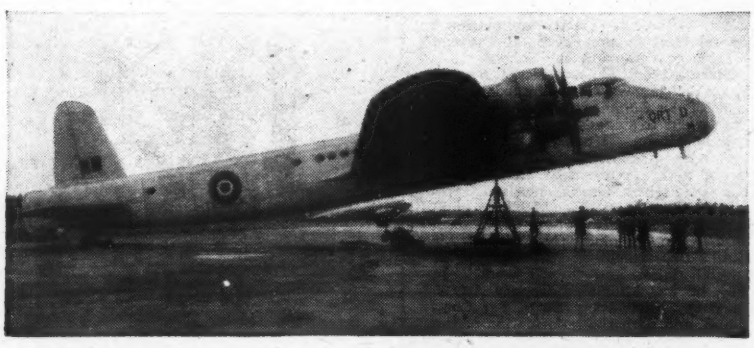
KILLED ON ACTIVE SERVICE.—Flt. Sgt. C. W. Akers; Sgt. W. J. Alexander; Flt. Lt. G. T. Bailey, D.F.C.; F/O. P. A. Bee; F/O. E. C. Bieri; F/O. P. S. Briggs; W/O. R. D. Cartwright; Flt. Lt. J. B. C. Catterns; L.A/C. L. R. V. Cox; Flt. Sgt. D. N. Everett; A/C.1 P. Fitzgibbon; Flt. Lt. J. C. Garnett; Sgt. J. M. B. Gordon; Sgt. L. G. Groves; P/O. C. E. Hall; F/O. J. J. F. Hobden; L.A/C. C. E. C. Hoborough; A/C.1 E. J. Lynott; F/O. L. G. McMillan; A/C.2 D. Martin; Flt. Sgt. W. H. Mathias; Flt. Sgt. J. Melling; Flt. Lt. D. W. Millard; Cpl. H. P. Mills; L.A/C. H. V. Morgan; Sgt. C. L. Morton; L.A/C. R. W. Nicholls; Flt. Lt. G. P. Ormesher; A/C.2 R. Owen; F/O. R. E. Pendle; L.A/C. E. A. G. Pettifer; L.A/C. S. Price; P/O. K. G. Proverbs; F/O. A. J. Reardon; L.A/C. E. R. Richings; Flt. Lt. E. J. J. Spiller; L.A/C. S. Thomas; A/C.2 A. R. Titford; Flt. Sgt. R. W. Vinton; L.A/C. T. S. Wallace.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. L. A. Howser.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. R. V. Carling.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. D. R. Turner.

DIED ON ACTIVE SERVICE.—A/C.1 O. Bannerman; Act. Sqn. Ldr. N. W. Beardsell; L.A/C. W. Benson; L.A/C. D. R. Branch; L.A/C. E. G. Burt; Flt. Sgt. M. A. W. Coatsworth; L.A/C. W. F. Cosliuich; L.A/C. W. F. Drage; F/O. J. H. Feresey; Cpl. L. E. M. Goddard; L.A/C. H. J. Grant; L.A/C. W. Hadfield; A/C.1 J. Hares; L.A/C. G. A. Harley; Sgt. J. W. Hathway; L.A/C. G. H. Hayes; L.A/C. D. R. Hinton; Act. Sqn. Ldr. A. S. Hunter; Sgt. J. C. Jones; Sqn. Ldr. J. A. F. MacLachlan, D.S.O., D.F.C.; Cpl. J. C. McLeod; Flt. Sgt. R. Minifie; A/C.2 T. O'Sullivan; Act. Sqn. Ldr. L. D. H. Palmer; Cpl. E. Partridge; L.A/C. J. Picken; L.A/C. H. C. J. Picton; L.A/C. V. R. Richards; L.A/C. F. W. Robinson; L.A/C. H. Skipsley; Act. Sqn. Ldr. J. W. Slade, D.F.C.; L.A/C. K. C. Spiller; Cpl. H. E. Stacey; L.A/C. T. A. Stark; L.A/C. W. A. Swan; W/O. R. F. Sumner; W/O. S. Theaker; A/C.1 E. C. Watts; L.A/C. H. Whittaker.



STIRLING ON STILTS : A Stirling V freighter of No. 1588 Heavy Freight Flight, operating in Malaya, undergoes a retraction test after overshooting the runway.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. J. I. Tailby.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—W/O. L. Collins.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. E. Armstrong; Flt. Sgt. R. Beard; Flt. Sgt. J. C. B. Boydell; Flt. Sgt. K. T. Brown; Flt. Sgt. J. R. Cottle; F/O. T. N. Downes; Flt. Sgt. W. W. Foy; Flt. Sgt. A. W. G. Fripp; Flt. Sgt. P. B. Giles; W/O. J. W. Godfrey; Flt. Sgt. A. E. Heap; Flt. Sgt. W. N. Heywood; Flt. Sgt. R. Howard; Act. F/O. R. A. Jones; W/O. J. S. Le Maire; Flt. Sgt. J. A. W. McKinnon; F/O. L. E. Murray; Flt. Sgt. P. J. Pearce; Flt. Sgt. W. R. Pearce; Flt. Sgt. A. J. Smith; Flt Sgt. F. G. Spencer; Flt. Sgt. K. J. Tomkins; W/O. L. W. Wheeler; Act. F/O. J. R. Worthington.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. P. J. Buckman; F/O. J. M. Johnston.

KILLED ON ACTIVE SERVICE.—Flt. Lt. P. J McNulty, D.F.C.; W/O. J. R. Potter.

DIED ON ACTIVE SERVICE.—Flt. Sgt. A. R. T Holden.

Royal Canadian Air Force

KILLED IN ACTION.—W/O. H. W. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. R. E. Vandette.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. B. B. Anderson; P/O. J. W. Ash; P/O. A. D. Aumell; F/O. G. R. Barry; F/O. F. K. Beers; F/O. D. Bell, D.F.C.; P/O. J. L. A. Blais; P/O. H. R. Brewer; F/O. A. G. Britten; Flt. Sgt. R. G. Carrothers; W/O. J. G. Chamberlin; Flt. Sgt. R. A. Chetney; Flt Sgt. K. C. Collins; P/O. R. L. Crooks; P/O. R. Dey; F/O. J. H. Doe; P/O. B. Dunlop; F/O. M. B. Dyer; P/O. F. H. Eade; P/O. J. Earl; F/O. F. C. Eastley; W/O. T. F. Galbraith; Flt. Sgt. J. A. Garbutt; P/O. J. R. Giles; F/O. D. W. Goodwin; P/O. A. F. Grant; F/O. J. E. Grant; W/O. R. J. Gregory; F/O. J. G. Hagell; P/O. W. St. C. Haley; P/O. J. A. Harvey; F/O. K. Heron; Flt. Sgt. L. A. Higgins; W/O. E. F. Henry; Sqn. Ldr. C. G. Hopton, D.F.C.; P/O. W. L. Hunter; P/O. A. Jacobs; Flt. Lt. D. W. Johnson; P/O. L. D. Kidd; Flt. Sgt. J. H Kitchin; P/O. C. H. McBrien; W/O. J. E. McClure; P/O. J. McCormick; F/O. J. C. McIver; F/O. G. E. Mallory; P/O. G. B. Martin; F/O. W. N. Moore; F/O. K. L. Moss; F/O. G. W. Murphy; F/O. E. O. Oke; P/O. L. A. Ouellette; F/O. A. M. Park; F/O. H. S. Peabody; Flt. Sgt. J. G. Pearce; P/O. J. B. Pittman; F/O. D. C. Pole; Flt. Sgt. D. A. Proudfoot; Flt. Sgt. R. G. Proulx; F/O. M. Rabovsky; F/O. E. E. Radcliffe; F/O. W. H. Sanders; F/O. D. J. Shapter; F/O. R. H. Shiells; P/O. J. Sibbald; P/O. J. H. Singer; Flt. Sgt. W. A. Streigh; P/O. J. E. Tazuk; F/O. K. D. Wallingford; P/O. E. C. Wilson; F/O. H. J. Wilson; P/O. W. E. Wood; P/O. C. T. Wright; P/O. J. F. E. Yates; Flt. Sgt. W. Yunsko.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. P. D. Ross-Ross.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. W. R. Hart; P/O. A. H. MacLeod.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. N. A. Good.

KILLED ON ACTIVE SERVICE.—P/O. D. S. Anderson.

DIED ON ACTIVE SERVICE.—P/O. R. A. Melles.

South African Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Lt. L. F. H. Catherine; W/O. R. G. Fletcher; Lt. K. E. George; Lt. A. L. Hawkes; Lt. J. E. Henky; Lt. T. J. C. Hopkins; Lt. C. J. Jooste; 2/Lt. W. Muller; W/O. A. S. Putter.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Maj. H. R. L. Alder; Capt. I. C. Allen; W/O. H. A. Annandale; 2/Lt. P. A. Armstrong; Lt. T. A. Bamber; Lt. C. G. Begg; W/O. E. R. Bezuidenhout; 2/Lt. J. P. Blanc; Lt. Col. M. Branby, D.F.C.; W/O. I. L. Cohen; Lt. N. Cooney; W/O. D. E. Douallier; W/O. R. H. Empey; Flt. Sgt. D. Emslie; Lt. L. V. Essery; Lt. B. V. Gesundheit; Lt. J. W. Gishford; Lt. D. R. Hjelm; Lt. J. Kerbel; Lt. J. A. Lithgow, D.F.C.; Lt. D. H. McHughs; Lt. K. B. MacWilliam; Air Mech. Medalie; Lt. P. Naylor; Lt. C. P. Nel; Lt. J. C. Nel; Lt. F. A. O'Connor; Lt. K. A. Patton; Lt. K. E. Ribbink; Lt. E. Rood; Lt. J. E. Sharpe; Lt. W. H. Spence; Lt. D. H. Taylor; Lt. J. W. M. Treu; Lt. B. J. Van Derhmerwe; Lt. T. R. Van Graan; Lt. F. A. Van Rensburg; Lt. U. Van-Rooyen; Lt. T. V. Vlok; Lt. C. B. Vorster; Lt. J. C. Webb; Lt. E. Williams; Lt. F. F. Youngleson.

MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. W. F. Steenkamp.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Lt. P. Kleyn; Lt. H. C. Stanton; Lt. J. A. Thomson

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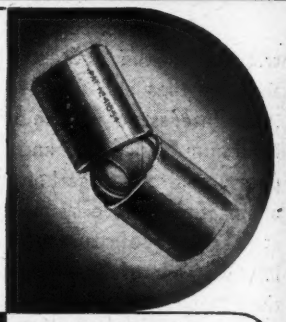

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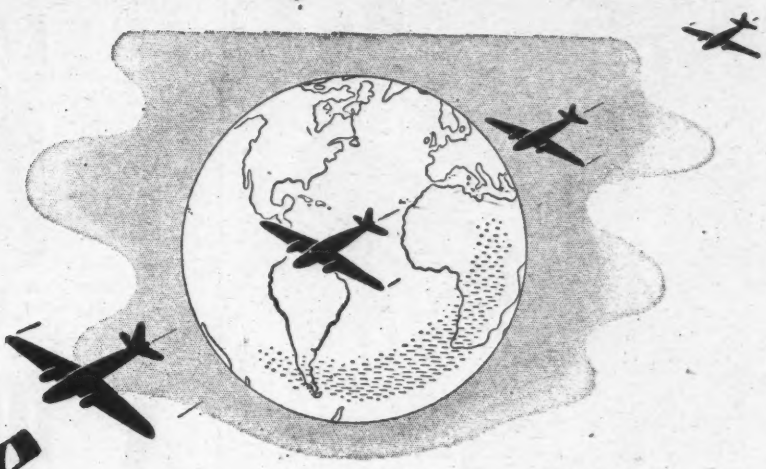

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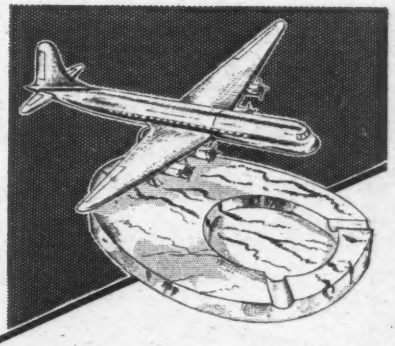

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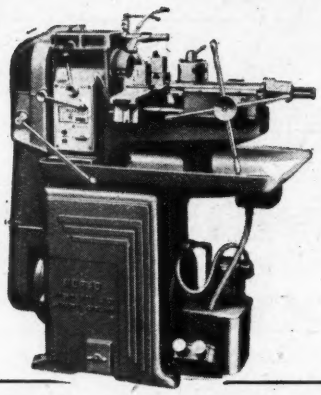

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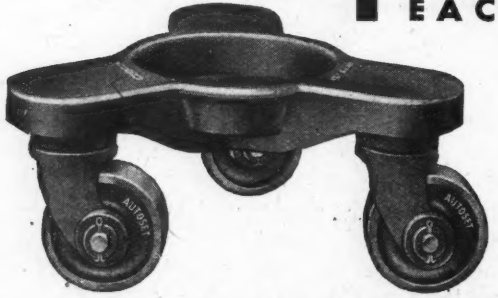

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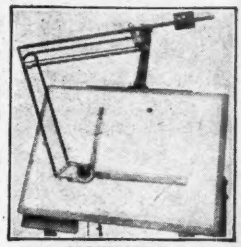

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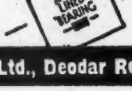

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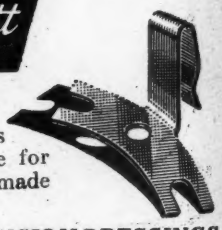

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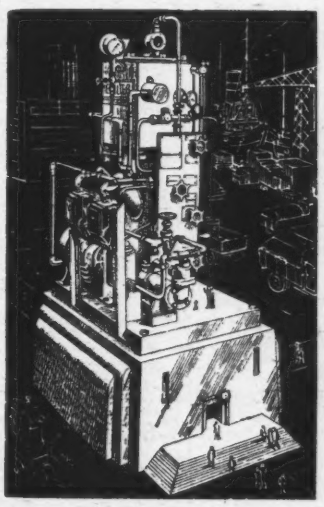

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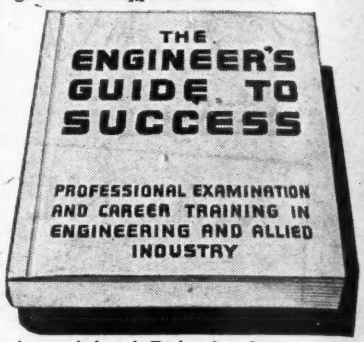

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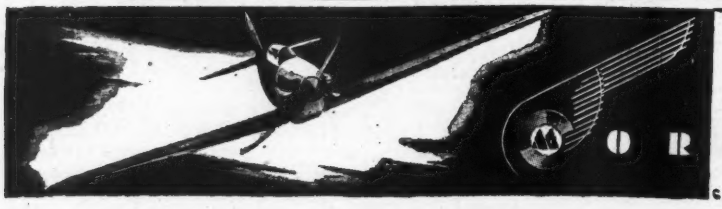

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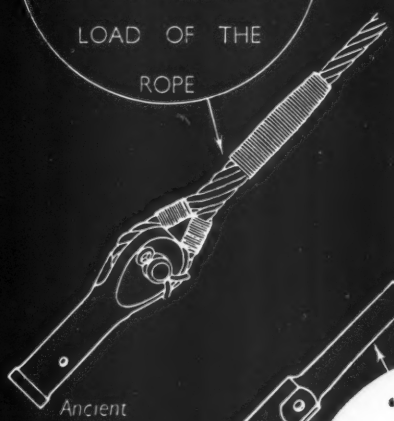

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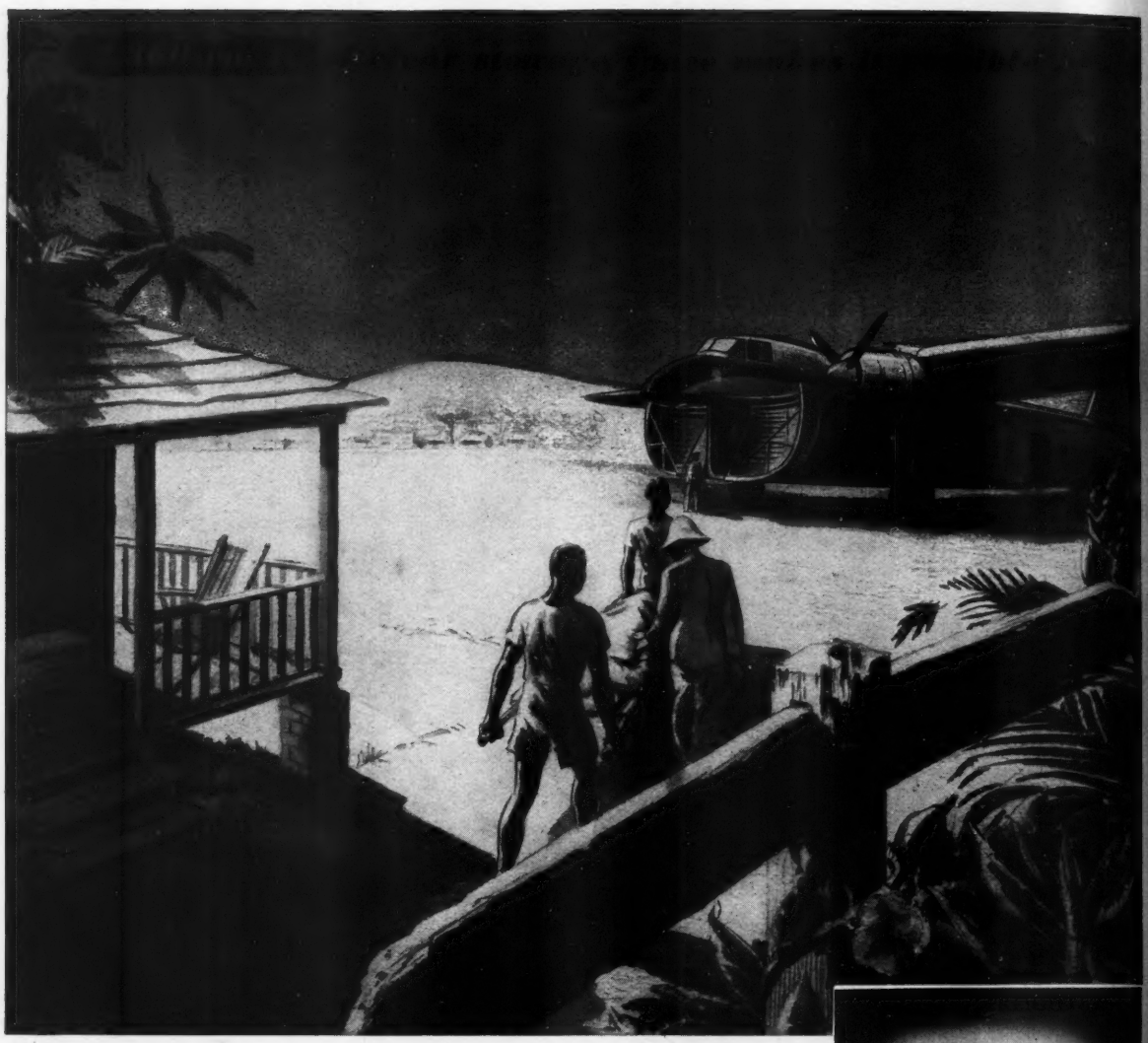

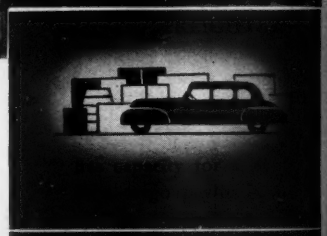

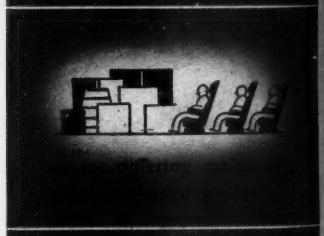

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